Product Technical Specification

nbn™ Ethernet Product Module

Wholesale Broadband Agreement

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Version	Description	Effective Date
3.0	First issued version of WBA 3	17 November 2017
3.1	NEBS supplied by means of the nbn™ FTTC Network	Later of the FTTC Commercial Launch Date and the Execution Date

Roadmap

A roadmap describing the structure of this **nbn**™ Ethernet Product Technical Specification follows for the assistance of Customer.

1 Scope and purpose

1.1 Purpose

This **nbn**™ Ethernet Product Technical Specification sets out the technical specifications for the **nbn**™ Ethernet Product. It forms part of the **nbn**™ Ethernet Product Module.

1.2 Scope

Sections 2 to 8 of this **nbn**™ Ethernet Product Technical Specification describe the features of the **nbn**™ Ethernet, as offered by **nbn**. Any differences in availability or performance of these features between access technologies are detailed in this **nbn**™ Ethernet Product Technical Specification and the Network Interface Specifications, where necessary.

1.3 Definitions

Capitalised terms used but not defined in this **nbn**™ Ethernet Product Technical Specification have the meaning given in the Dictionary.

If a capitalised term used in this document is not defined in the Dictionary, then that term has the ordinary meaning commonly accepted in the industry.

2 Introduction

2.1 Service Type Availability

This section provides a brief overview of the service types that Customer may choose to deploy using **nbn**™ Ethernet.

2.1.1 Unicast Data Services

nbn™ Ethernet supports the flexible delivery of unicast data services. **nbn**™ Ethernet uses logical, Layer 2 circuits that provide transparency to network layer protocols such as IPv4 and IPv6 that enable access to a variety of higher-level data applications, including internet access and tunnelling protocols.

These unicast services provide physical point-to-multipoint (aggregated) connectivity between one or more UNIs located at a Premises and a centrally-aggregated NNI supplied to Customer by **nbn**.

2.1.2 IP-Based Telephony Services

Customer may choose to provision IP-based telephony services to End Users via:

- an ATA port (integrated into the NTD), with integrated SIP capabilities for legacy telephony applications (UNI-V) in relation to **nbn**™ Ethernet (Fibre); or
- access to external, Customer-supplied ATA devices using (with a unicast data service) a UNI-D in relation to **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (Wireless), **nbn**™ Ethernet (HFC) , **nbn**™ Ethernet (FTTC) or **nbn**™ Ethernet (Satellite) or a UNI-DSL in relation to **nbn**™ Ethernet (FTTB) or **nbn**™ Ethernet (FTTN).

If Customer wishes to deliver IP-based telephony services, Customer must provide and manage its own IP-based telephony network capabilities that interface to, and operate across, the **nbn**™ Network.

All IP-based protocols and functions that Customer utilises to implement IP-based telephony services which comply with this Agreement will pass transparently through the NNI, AVC, CVC and UNI-D or UNI-DSL Product Components. Where utilised in relation to **nbn**™ Ethernet (Fibre) supplied to a Premises, the UNI-V will terminate all IP-based telephony protocols and functions within the F-NTD at the Premises and provide POTS services from the UNI-V electrical interface to the End User.

The **nbn**™ Network supports the provision of voice-grade, IP-based telephony services through the use of specific traffic handling mechanisms that are tailored toward deterministic performance for real-time, conversational applications. The TC-1 traffic class is designed to accommodate the needs of IP-based telephony applications.

Capacity within this traffic class is available to Customer via the UNI-D in relation to **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (Wireless), **nbn**™ Ethernet (HFC), **nbn**™ Ethernet (FTTC) or **nbn**™ Ethernet (Satellite), the UNI-DSL in relation to **nbn**™ Ethernet (FTTB) or **nbn**™ Ethernet (FTTN). Capacity within this class is also available via the UNI-V in relation to **nbn**™ Ethernet (Fibre) only.

2.1.2.1 Legacy Telephony Applications

Using the UNI-V for **nbn**™ Ethernet (Fibre), Customer may access the F-NTD's in-built ATA port to provide capabilities for supported legacy telephony applications.[1] A range of configuration options enable Customer to migrate an existing telephony service, with minimal impact to in-building wiring or equipment installed at the Premises.

The ATA function of the UNI-V converts legacy analogue telephony services on the End User-side of the port to and from IP-based services on the network-side of the port.

IP-based telephony services deployed using the UNI-V are automatically provisioned with a specific TC-1 capacity allocation.

Customer must interface its own IP-based telephony network with the IP-based telephony functions provided by the internal ATA of a UNI-V port. This will require integration testing between Customer and **nbn** prior to service deployment in accordance with this Agreement.

2.1.2.2 External ATA Device Support

Subject to the **nbn**™ Ethernet Product Description, Customer may choose to deliver IP-based telephony services to a Premises using a dedicated, external ATA device using the UNI-D or UNI-DSL. The supply, powering and operation of this device are the responsibility of Customer.

Such devices will, subject to compatibility, appear to **nbn**™ Ethernet as a regular data device.

Customer may choose to operate the AVC in a manner that recognises the relative priority of telephony traffic above other applications sharing the same AVC.

Under this deployment scenario, **nbn**™ Ethernet is agnostic to the IP-based telephony protocols and data that Customer utilises for the delivery of IP-based telephony services to an End User.

When delivering IP-based telephony services using an external ATA through a UNI-D or UNI-DSL, Customer is able to utilise capacity from any available traffic class.

2.1.3 Multimedia Distribution Services

nbn™ Ethernet (Fibre) supports an Ethernet-based Layer 2 virtual connection that supports multicast capabilities, for the efficient distribution of multimedia content by Customer to multiple End Users in a single CSA simultaneously.

This capability is designed to support the secure and dynamic delivery of multiple media streams at a variety of bit-rates. This capability operates in an environment designed to allow other simultaneous services (such as unicast data and IP-based telephony services) to be provided by Customer on the same UNI-D.

[1] For information on supported voiceband data services, refer to section 4 of the Network Interface Specification – UNI-V.

2.2 Class of Service (CoS) Architecture

The **nbn**™ Network implements a number of traffic classes that are distinguished in capability and performance, designed to accommodate the widest variety of higher-layer applications. Customer may take advantage of these traffic classes to provide more tailored performance and effective utilisation of the **nbn**™ Network.

2.2.1 Traffic Classes

Traffic is scheduled within the **nbn**™ Network using strict priority, according to the traffic class. The available traffic classes are described in Table 1.[2]

Traffic Class	Example Applications	Specification
TC-1	Voice	CIR
TC-2	Streaming standard and high definition video and real-time collaboration applications	CIR
TC-4	Best-effort data	PIR[3] (AVC) CIR[4] (CVC)
TC-MC	Delivery of Media Streams using Layer 2 multicast	CIR[5]

Table 1: Available Traffic Classes

Customer may use these classes to allocate service capacity in a manner that reflects the demands and operation of its end-to-end applications. The performance attributes of each respective traffic class are described in section 7.

Note that for traffic classes where Customer is required only to specify the CIR (i.e. for which the PIR is not specified), the PIR will be automatically set by **nbn** to align with the specified CIR according to the relevant traffic class.

For traffic classes which do not support a CIR (e.g. AVC TC-4), no CIR is provided.

2.2.1.1 TC-1 Description

The TC-1 traffic class is targeted towards real-time, interactive multimedia applications, with the following characteristics:

- Low bit-rate

[2] See section A.6.3 of Appendix A to this **nbn**™ Ethernet Product Technical Specification for details on which traffic classes in Table 1 are supported on each network.

[3] TC-4 is implemented as PIR at the AVC, meaning that AVC TC-4 capacity is shared with other traffic classes across the UNI and is available for TC-4 when higher-priority traffic classes are not utilising it.

[4] TC-4 is implemented as CIR at the CVC, meaning that CVC TC-4 capacity cannot be shared with other CVCs or traffic classes across the NNI.

[5] TC-MC is implemented as CIR in respect of each Media Stream at the Multicast Domain, meaning that TC-MC capacity cannot be shared with other Multicast Domains, Media Streams or traffic classes across the NNI.

- Low Frame Delay, Frame Delay Variation, Frame Loss

The attributes of this class are aligned to the characteristics of the DSCP Expedited Forwarding per-hop behaviour described in RFC4594.

TC-1 provides a committed level of premium capacity with limited ability to burst above its CIR, suitable for applications that require deterministic performance and are likely to be sensitive to packet loss.

2.2.1.2 TC-2 Description

The TC-2 traffic class is targeted towards real-time, interactive multimedia applications, with the following characteristics:

- High bit-rates, and large Ethernet Frame Sizes
- Low Frame Delay, Frame Delay Variation, Frame Loss

The attributes of this class are aligned to the characteristics of the DSCP Assured Forwarding (**AF**) per-hop behaviour described in RFC4594.

TC-2 provides a committed level of premium capacity with limited ability to burst above its CIR, suitable for applications that require deterministic performance and are likely to be sensitive to Frame Delay Variation (FDV/jitter) and Frame Loss (FLR).

2.2.1.3 TC-4 Description

The TC-4 traffic class is targeted towards “best effort” applications, as characterised by the DSCP Default Forwarding per-hop behaviour, described in RFC4594.

2.2.1.4 TC-MC Description

The TC-MC traffic class is targeted towards multicast delivery of uni-directional (downstream) media content.

TC-MC is designed to provide a committed level of capacity with no ability to burst above its CIR.

2.2.2 Bandwidth Profile Parameter Considerations

This section describes the bandwidth profile parameters used within the **nbn**™ Network.

2.2.2.1 Calculation of Information Rate

All Information Rate limitations, including as set out in this **nbn**™ Ethernet Product Technical Specification, are enforced at the NNI interface between the Customer and the **nbn**™ Network.

Where the bandwidth profile is equivalent to or greater than the negotiated Line Rate, a degraded useable payload will occur.

The effective Layer 2 payload rate of the **nbn**™ Network will degrade slightly for lowest-sized Ethernet service frames. This is the expected behaviour for Ethernet-based services for which the bandwidth profile is based on the service frame definitions in the relevant Network Interface Specification. It is the responsibility of Customer to accommodate any payload rate degradation as a result of Layer 2 Frame Sizes.

2.2.2.2 Committed Burst Size

The CBS is set by **nbn** for each CIR specification, and cannot be modified. The CBS may differ between traffic classes, and may be specified differently for the UNI and NNI, and between the AVC and CVC.

The CBS is used by the policing functions of the **nbn**™ Network at ingress to the **nbn**™ Network to determine whether a stream of ingress data complies with the subscribed CIR. Customer is responsible for ensuring that all ingress traffic is shaped to comply with the CIR/CBS as specified for the required traffic class and interface, before presentation to the UNI or NNI as relevant. CBS values are set out in the Network Interface Specification – AVC.

2.2.2.3 Peak Information Rate

Traffic capacity in excess of the CIR and within the PIR will be carried through the **nbn**™ Network without any performance objectives. Traffic that exceeds the PIR will be discarded at ingress to the **nbn**™ Network.

PIR is subject to the limitations described in sections 3.2.2.3 and 3.3.2.2 of this **nbn**™ Ethernet Product Technical Specification and sections 3 and 13 of the **nbn**™ Ethernet Product Description.

2.2.2.4 Peak Burst Size

The PBS defines the length of a burst of Layer 2 traffic (either in bytes or milliseconds as set out in the Network Interface Specifications) that may be received at ingress to the **nbn**™ Network for a burst of traffic that pushes the average Information Rate above the configured bandwidth profile for a PIR traffic class. Traffic in excess of the PBS will be discarded by the **nbn**™ Network. The PBS is set by **nbn** for each PIR specification, and cannot be modified.

The PBS is used by the policing functions of the **nbn**™ Network at ingress to the **nbn**™ Network to determine whether a stream of ingress data complies with the subscribed PIR. Customer is responsible for ensuring that all ingress traffic is shaped to comply with the PIR/PBS as specified for the required traffic class and interface, before presentation to the UNI or NNI as relevant.

2.2.3 Traffic Contention and Congestion Management

Customer may control End User experience of applications using the unicast functionality of **nbn**™ Ethernet through contention applied through dimensioning of capacity between the AVC and CVC, subject to the conditions set out in the **nbn**™ Ethernet Product Description.

Contention may be applied at the traffic class level, allowing Customer to independently control the economics and operation of each traffic class. This is controlled by Customer through careful dimensioning of AVC and CVC capacity, on a traffic class basis, to ensure a level of contention appropriate for each respective higher-layer application.

Customer must be aware of the implications of contending AVC and CVC components, as this will effectively degrade the performance of Customer Products and Downstream Products.

2.3 Multicast Architecture

Only **nbn**™ Ethernet (Fibre) provides an Ethernet-based Layer 2 multicast functionality for the support of Customer's higher-layer, IP-based multicast architecture, as typically used for IPTV applications.

nbn™ Ethernet (Fibre) implements Layer 2 multicast functions using a dedicated Multicast Domain (a functional variant of the CVC which is specific to multicast applications) and a Multicast AVC (a functional variant of the AVC which is specific to multicast applications).

The Multicast Domain must terminate on an NNI and, subject to section 1.1(e) of the **nbn**™ Ethernet Product Description, may use any NNI supplied by **nbn** to Customer for the delivery of unicast services in the same CSA as the Multicast Domain or be provisioned on its own dedicated NNI.

The Multicast Domain is specified in terms of overall capacity in a similar manner to a unicast CVC. In addition, the Multicast Domain requires the further specification of individual Media Streams by Customer within the Multicast Domain, as required for each specific media flow (e.g. an IPTV channel or audio stream) into the Fibre Network. These Media Streams are then replicated by the Fibre Network to individual Multicast AVCs, in response to Multicast AVC IGMPv3 leave/join requests.

The supply of the Multicast AVC to Customer is on the condition that Customer also acquire a unicast AVC in conjunction with the Multicast AVC (mapped to the same UNI-D). The Multicast AVC will utilise the unicast capacity as an upstream control path.

2.3.1 Multicast Architecture

The multicast functionality of **nbn**™ Ethernet (Fibre) is based on IEEE802.3 Ethernet multicast addressing and operation, using IGMPv3[6] to manage media stream replication.

The multicast functionality of **nbn**™ Ethernet (Fibre) is designed to monitor (proxy) the upstream unicast data stream for IP-layer IGMP multicast packets. These IGMP packets are designed to identify channel-change events in a multicast service, and are used to determine which of Customer's individual Media Streams to transmit in the downstream Multicast AVC.

Currently, only IPv4 multicast services are supplied by the Multicast AVC and Multicast Domain.

2.3.2 Multicast Operation

The multicast functionality of **nbn**™ Ethernet (Fibre) is implemented using a dedicated Multicast AVC and dedicated Multicast Domain, operating in the downstream direction only. The Multicast Domain requires the presence of a bi-directional, unicast AVC and CVC for the communication of channel-change and control information from the End User back into the Customer Network.

[6] The Multicast capabilities are backward compatible to IGMPv2. IGMPv1 is not supported.

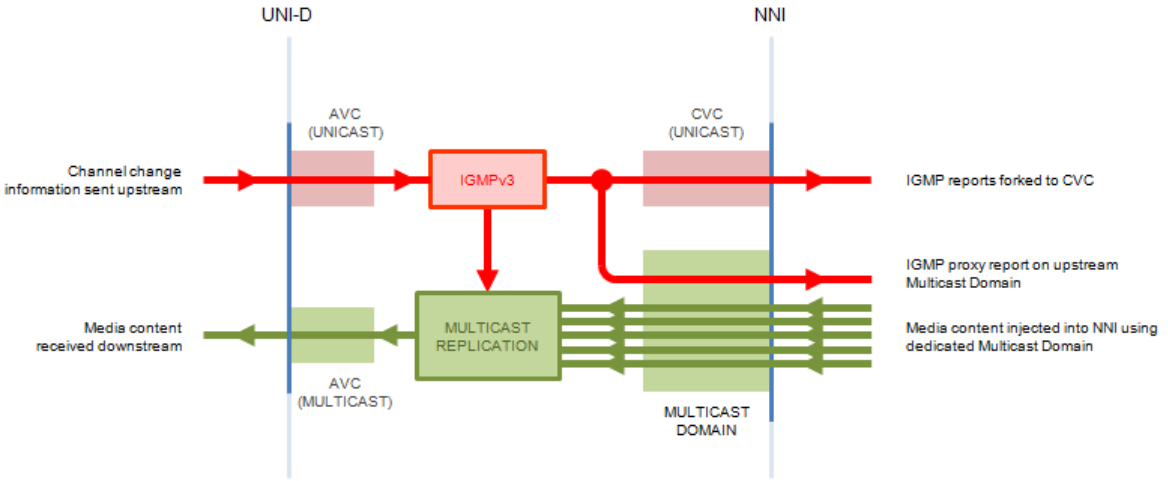

Figure 1: Multicast Operation

Figure 1 depicts the operation of a multicast service to a single UNI-D. The upper (red) data flow represents a unicast AVC that supports bi-directional data services. This AVC carries the End User's channel change information from the UNI-D, through the CVC, to the NNI for transmission to the Customer Network.

The Fibre Network intercepts this information to detect any changes to the multicast data flow requested by the End User, and proxies this information to Customer through the NNI.

The lower (green) data flow represents the downstream, multicast traffic flow. This data is injected by Customer at the NNI on a single Multicast Domain. It is then replicated to Multicast AVCs, in accordance with the IGMP information as intercepted in the upstream traffic of the AVC.

A residential gateway interfacing with UNI-D must support "IGMP Proxy" if implemented by Customer as a router. However, if Customer configures the residential gateway as a bridge, it must not implement "Report Suppression" (in case IGMPv2 is used).

2.3.3 Multicast Performance

Customer must consider the following performance attributes when designing its IPTV service architecture to utilise multicast capabilities:

- Multicast Domain capacity management
- Multicast AVC capacity management
- Media Stream capacity management

2.3.3.1 Multicast Domain Capacity Management

The Multicast Domain must be dimensioned as equal to, or greater than, the aggregate Media Stream capacity. Admission controls are applied to Media Streams at ingress to the Multicast Domain as shown in Figure 2.

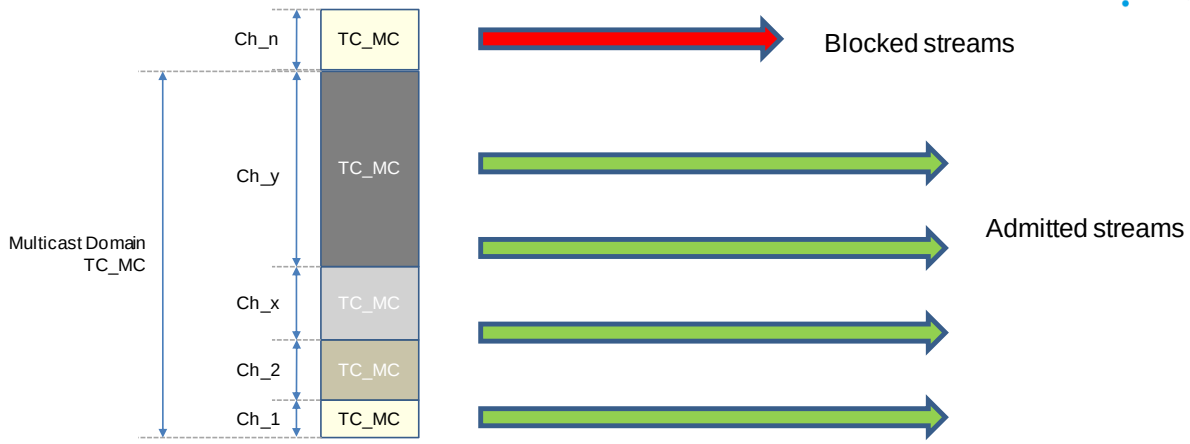

Figure 2: Multicast Domain Capacity Management

No signalling notification will be provided to Customer by the **nbn**™ Network when a Media Stream is blocked.

2.3.3.2 Multicast AVC Call Admission Control (Capacity Management)

Call Admission Controls (CAC) are applied to Media Streams requests at ingress to the Multicast AVC.

Requests to join a Media Stream are rejected where the addition of the requested Media Stream would exceed the configured capacity of the Multicast AVC.

No controls are applied to the number of Media Streams being streamed on a Multicast AVC provided that the aggregate capacity does not exceed the configured Multicast AVC capacity.

No signalling notification will be provided to Customer by the **nbn**™ Network when a request to join a Media Stream is rejected.

2.3.3.3 Media Stream Capacity Management

Customer must nominate the peak capacity for each Media Stream at the time of submitting a Product Order Form, and each Media Stream is monitored at ingress to the Multicast Domain.

Customer is encouraged to implement Forward Error Correction in the Customer Network in relation to each Media Stream to ensure the best available End User experience of the IPTV service or other Customer Product or Downstream Product, which Customer must factor into calculations when determining the required peak bandwidth capacity.

In cases where there is an Exceeded Configured Peak Bandwidth Event, forwarding of Media Stream frames from the non-conforming Media Stream is suspended by the **nbn**™ Network until the Media Stream has conformed to the configured peak bandwidth.

No signalling notification will be provided to Customer through the NNI when an Exceeded Configured Peak Bandwidth Event occurs and a Media Stream is suspended.

3 User Network Interface (UNI)

3.1 Overview

3.1.1 UNI Type

The **nbn**™ Ethernet UNI Product Component has three variants:

- UNI-D: Ethernet UNI port for the purpose of data carriage
- UNI-DSL: VDSL2 UNI port for the purpose of data carriage
- UNI-V: Analogue POTS UNI port for the purpose of voice telephony service

The UNI type availability is dependent on the access technology deployed:

	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
UNI-D	Available	Not Available	Available	Available	Available	Available
UNI-DSL	Not Available	Available	Not Available	Not Available	Not Available	Not Available
UNI-V	Available	Not Available	Not Available	Not Available	Not Available	Not Available

Each UNI is logically connected to an NNI via an AVC.

Each UNI-D and UNI-DSL supports a single unicast AVC.

Each **nbn**™ Ethernet (Fibre) UNI-D supports an additional optional single Multicast AVC.

3.1.2 Addressing Mode

The UNI-D and UNI-DSL support four interface tagging and prioritisation addressing modes:

- Default-Mapped: untagged; activation enabled QoS
- DSCP-Mapped: untagged; DSCP enabled QoS
- Priority-Tagged: single tagged (null/unpopulated); 802.1p enabled QoS
- Tagged: single tagged (customer provided); 802.1p enabled QoS

The availability of these options for addressing services at the UNI-D and UNI-DSL is summarised in section A.5.2 of Appendix A to this **nbn**™ Ethernet Product Technical Specification and further detailed in the Network Interface Specification – UNI-D and Network Interface Specification – UNI-DSL.

Not all options for addressing mode are available on all networks.

UNI-V is configured to support only the DSCP-Mapped addressing mode for SIP traffic.

3.2 UNI-D

The UNI-D is an Ethernet interface in compliance with IEEE 803.2 standards. Each UNI-D is regarded as a fully independent interface, operating in total isolation from any other UNI residing on the same NTD or FTTC-NCD, except that the aggregate of all UNI-D Line Rates on:

- an NTD cannot exceed the relevant NTD throughput limit set out in section 13.3 of the **nbn**™ Ethernet Product Description; and
- an FTTC-NCD cannot exceed the relevant FTTC-NCD throughput limit set out in section 13.4 of the **nbn**™ Ethernet Product Description.

Detailed specifications are set out in the Network Interface Specification – UNI-D.

3.2.1 Physical Interface

The following interface modes are available via the UNI-D:

Interface modes	Fibre Network	HFC Network	FTTC Network	Wireless Network	Satellite Network
10/100/1000BASE-T/TX (electrical, auto-negotiated speed and full/half-duplex[7]	Available	Available	Available	Available	Available
100BASE-T (electrical, fixed speed, auto-negotiated full/half-duplex)	Available	Available	Not available	Available	Not available

The UNI-D must be associated with an active AVC at all times.

3.2.2 UNI-D Scalability Factors

The UNI-D is scalable in terms of capacity and services. Each UNI-D has two capacity metrics that define its ability to carry Customer Products and Downstream Products.

3.2.2.1 Line Rate

The UNI-D supports the following Ethernet Line Rates:

[7] Half-duplex is not supported on the 1000BASE-T/TX interface for **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (HFC), **nbn**™ Ethernet (FTTC) or **nbn**™ Ethernet (Wireless), or any interface for **nbn**™ Ethernet (Satellite).

- 10Mbps
- 100Mbps
- 1000Mbps

The Line Rate sets the maximum bound on the information-carrying capacity of the link. Customer must be familiar with the inherent limitations of Ethernet in relation to the impact of framing overhead and asynchronous operation on bandwidth efficiency, and accommodate this within any capacity allocation.

By default, the UNI-D will be configured to auto-negotiate the Line Rate with the End User Equipment attached to the UNI-D. An active UNI-D may be configured by **nbn** as a 100Mbps interface if required by Customer.[8]

Customer is responsible for ensuring that the UNI-D is operating with a Line Rate that is sufficient to carry the requested AVC capacity, using auto-negotiation or, where available, a fixed Line Rate setting requested by Customer.

Customer is also responsible for the Duplex mode of the UNI-D.

3.2.2.2 Access Line Rate

For **nbn**™ Ethernet (FTTC), the Access Line Rate sets the maximum bound on the information-carrying capacity of the copper pair between the **nbn**™ Downstream Network Boundary and the **nbn**™ Node.

The Access Line Rate achieved on the **nbn**™ Copper Pair is determined by the xDSL Data Rate achieved on that **nbn**™ Copper Pair and is subject to the limitations described in sections 3 and 13 of the **nbn**™ Ethernet Product Description.

Customer must be familiar with the inherent performance characteristics of xDSL technologies.

The Access Line Rate will depend on:

- the **nbn**™ Copper Pair line length and attenuation
- the number of other data services that share common network cable runs
- framing overheads, asynchronous operation and the impact on bandwidth efficiency
- the use of Downstream Power Back-off
- retransmissions
- operations and maintenance traffic

3.2.2.3 Information Rate

For **nbn**™ Ethernet (FTTC), the UNI-D Information Rate is subject to the Line Rate. In a Premises at which **nbn** supplies **nbn**™ Ethernet (FTTC), the Information Rate is further subject to any limitations of the Access Line Rate.

[8] Not supported for **nbn**™ Ethernet (Satellite).

As such a UNI-D is capable of supporting an Information Rate up to the lesser of the Line Rate or the Access Line Rate.

A UNI-D is capable of supporting an Information Rate up to the active Line Rate. For example,[9] a UNI-D that has an auto-negotiated Line Rate of 100Mbps is capable of supporting an AVC with a PIR of 100Mbps.

The Information Rate is also subject to the limitations described in sections 3 and 13 of the **nbn**™ Ethernet Product Description. Note that once provisioned, AVC capacity will not be automatically re-adjusted as a result of changing Line Rates through auto-negotiation. Should a UNI-D auto-negotiate to a Line Rate less than the requested AVC rate, the End User may experience increased Frame Loss in excess of the Frame Loss targets for each traffic class on the provisioned AVC as set out in section 7.1.

3.2.3 AVC Support

For **nbn**™ Ethernet (Fibre), the UNI-D functionally supports a single, bi-directional, unicast AVC and an optional, uni-directional Multicast AVC.

For **nbn**™ Ethernet (Wireless), **nbn**™ Ethernet (HFC), **nbn**™ Ethernet (FTTC) or **nbn**™ Ethernet (Satellite), the UNI-D functionally supports a single, bi-directional, unicast AVC.

3.2.4 Resiliency

The UNI-D is an unprotected physical interface. If an unprotected UNI-D suffers a failure, all services being delivered across that UNI will be disrupted.

3.2.5 NTD Supply

Customer cannot directly order an NTD. The provision and operation of the NTD is the responsibility of **nbn** and is dependent on the access technology.

By default, in respect of a Premises at which **nbn** will supply **nbn**™ Ethernet (Fibre), an internal F-NTD will be provided unless **nbn** determines that an external F-NTD is preferable in the circumstances or an End User indicates a preference for an external F-NTD during installation and agrees to any additional charges that may apply. This is described further in section 2 of the Network Interface Specification - Premises Network Devices.

nbn will provide a W-NTD in relation to a Premises at which **nbn** will supply **nbn**™ Ethernet (Wireless), as described in section 3 of the Network Interface Specification - Premises Network Devices.

nbn will provide an S-NTD in relation to a Premises at which **nbn** will supply **nbn**™ Ethernet (Satellite), as described in section 4 of the Network Interface Specification – Premises Network Devices.

nbn will provide an HFC-NTD in relation to a Premises at which **nbn** will supply **nbn**™ Ethernet (HFC), as described in section 5 of the Network Interface Specification - Premises Network Devices.

NTDs are designed to operate within certain environmental conditions, which may be set out in the Network Interface Specification – Premises Network Devices. If an NTD is subjected to environmental conditions outside

those expressly permitted, **nbn**™ Ethernet Ordered Products supplied using the NTD may not perform in accordance with the **nbn**™ Ethernet Product Description or this **nbn™ Ethernet Product Technical Specification**.

3.2.6 FTTC-NCD

3.2.6.1 Supply

nbn will provide an FTTC-NCD in relation to a Premises at which **nbn** will supply **nbn**™ Ethernet (FTTC), as described in section 6 of the Network Interface Specification - Premises Network Devices.

The provision and operation of the FTTC-NCD is the responsibility of **nbn**.

3.2.6.2 Reverse Power Feed

The FTTC-NCD provides a Reverse Power Feed to the **nbn**™ DPU via the **nbn**™ Copper Pair.

3.2.6.3 Co-existing Services and Customer provided equipment interoperability

Customer premises equipment which is not compatible with **nbn**™ Ethernet (FTTC), including equipment relating to any legacy services (such as telephony handsets, modems and alarm diallers) must, to avoid causing **nbn**™ Ethernet (FTTC) service interruptions:

- be physically unplugged from the Premises internal wiring connecting to the FTTC Network prior to installation of the FTTC-NCD; and
- remain unplugged from the Premises internal wiring connecting to the FTTC Network after installation of the FTTC-NCD.

See section 6 of the Network Interface Specification – Premises Network Devices for further details regarding the disconnection of equipment which is incompatible with **nbn**™ Ethernet (FTTC).

3.3 UNI-DSL

The UNI-DSL is a VDSL2 interface in alignment with ITU-T G.993.2 (01/15) and supporting standards. Each UNI-DSL is regarded as a fully independent interface, operating in total isolation from any other UNI-DSL interfaces.

Detailed specifications are set out in the Network Interface Specification – UNI-DSL.

3.3.1 Physical Interface

The availability of UNI-DSL physical interface relating to the **nbn**™ Ethernet (FTTB) or **nbn**™ Ethernet (FTTN) is specified in section 4 of the **nbn**™ Ethernet Product Description.

3.3.2 UNI-DSL Scalability Factors

The UNI-DSL is scalable in terms of capacity and services. Each UNI-DSL has two capacity metrics that define its ability to carry Customer Products and Downstream Products.

3.3.2.1 Line Rate

The Line Rate sets the maximum bound on the information-carrying capacity of the link. The Line Rate achieved on the UNI-DSL is impacted by the reported DSL Actual Data Rate and is subject to the limitations described in sections 3 and 13 of the **nbn**™ Ethernet Product Description.

Customer must be familiar with the inherent performance characteristics of VDSL2 and that achieved Line Rates will depend on:

- the copper pair line length and attenuation, including in-building cabling or lead-in length
- the state of copper wiring in-building or in the Premises
- the number of other data services that share common network cable runs
- framing overheads, asynchronous operation and the impact on bandwidth efficiency
- the presence of pre-existing exchange based services (e.g. ADSL) within a cable run and the use of Downstream Power Back-off
- G.Inp retransmissions.

The UNI-DSL will be configured to auto-negotiate Line Rates with the End User Equipment.

3.3.2.2 Information Rate

For DSL services the Information Rate is limited to the lesser of the aggregate AVC bandwidth and the actual Line Rate on the UNI-DSL. Note also that for VDSL2 the Line Rate and Information Rate are subject to VDSL2 Ethernet over copper framing overheads as defined in the ITU-T VDSL2 specification G.993.2.

The Information Rate is also subject to the limitations described in sections 3 and 13 of the **nbn**™ Ethernet Product Description.

Note that once provisioned, AVC bandwidth profiles will not be automatically re-adjusted as a result of DSL negotiated Line Rates. Should a UNI-DSL auto-negotiate to a Line Rate less than the requested AVC rate, the End User may experience increased Frame Loss in excess of the Frame Loss targets for each traffic class on the provisioned AVC as set out in section 7.1.

3.3.2.3 CIR on DSL

Committed Information Rate (CIR) bandwidth profiles and performance targets are subject to the Line Rate at the UNI-DSL, where:

$TC\text{-}1_{CIR}$ + $TC\text{-}2_{CIR}$ + 1 Mbps ≤ Line Rate (for L2 Bitstream Capacity)

3.3.3 AVC Support

For **nbn**™ Ethernet (FTTB) or **nbn**™ Ethernet (FTTN), the UNI-DSL functionally supports a single, bi-directional, unicast AVC.

3.3.4 Resiliency

The UNI-DSL is an unprotected physical interface. If an unprotected UNI-DSL suffers a failure, all services being delivered across that UNI-DSL will be disrupted.

3.3.5 Customer Premises Equipment Supply

The provision and operation of an active device that interfaces with the Ethernet bitstream on the End User side of the downstream **nbn**™ Network Boundary for **nbn**™ Ethernet (FTTB) or **nbn**™ Ethernet (FTTN), which is subject to VDSL2 Equipment compatibility and registration as specified in section 28 of the **nbn**™ Ethernet Product Terms and section 5.4.2 the WBA Operations Manual, is the responsibility of Customer.

3.4 UNI-V

The UNI-V is only supplied as a variant of the UNI Product Component of **nbn**™ Ethernet (Fibre).

The End User's side of the UNI-V is an analogue telephony interface provided off a port on the NTD in alignment with AS/CA S002:2010 standards. Detailed specifications of the physical analogue interface are set out in the Network Interface Specification – UNI-V.

nbn's side of the UNI-V is a VoIP SIP client interface provided by an internal ATA in the NTD in alignment with RFC3261 (SIP), RFC2327 (SDP), RFC3264 (SDP) and RFC3550 (RTP) standards. Detailed specifications of the logical VoIP interface are set out in the Network Interface Specification – UNI-V.

3.4.1 Initialisation and Configuration Protocols

The UNI-V utilises Unicast N:1 AVC TC-1 and Unicast N:1 CVC TC-1 for the transportation of voice packets.

The UNI-V uses DHCPv4 protocol to establish IP addressing and to identify TR-069 Auto-Configuration Server (ACS) bootstrap configuration details. Customer is required to provide an interoperable DCHPv4 server for the DHCPv4 client implementation on the UNI-V.

The UNI-V employs TC-1 and 802.1p/DSCP encoding mechanism for CoS.

The UNI-V utilises DSL Forum Technical Report 069 (TR-069), 098 (TR-098) and 104 (TR-104) protocols for Customer to further configure the SIP client implemented on the UNI-V. Customer is required to provide an interoperable ACS server to configure and manage the UNI-V SIP client.

The UNI-V supplies IPv4-based SIP services only. **nbn** currently intends to support IPv6-based SIP services in the future.

3.4.2 Call Features

The UNI-V supports a limited set of IP-based telephony features. It is the responsibility of Customer to interface to the UNI-V with a soft switch, located beyond the NNI, and complete the delivery of these features with complementary feature support within the Customer Network.

The IP-based telephony call features supported by the UNI-V are described as follows:

Any call feature not explicitly stated below is to be treated as an unsupported call feature of UNI-V.

Call Feature	Description / Sub-Features	Status
Basic POTs Service	• Outbound / inbound call • No answer • Abandoned call	Supported

Voice Codecs (G.711ALaw)	• G.711ALaw • Voice Quality on local call: 80 - 93 • Packetisation: 20ms • Avg media bandwidth: 101 kbps • PSTN-equivalent: yes • Support for G.168 Section 7: CPE must conform to AS/CA S002:2010 Appendix A for echo canceller/suppressor disable tones.	Supported
Voice Codecs (Others)	• G.711MuLaw • G.729 • Any other codecs	Unsupported
Call Waiting	• Handling before accepting the second incoming call • Handling after accepting the second incoming call	Supported
Call Waiting Suspend (Single Call)	• New call • Existing call	Supported
Call Forward (supported)	• Busy • No answer • Unconditional	Supported
Call Forward (unsupported)	• Splash ring / ping ring • Special dial tone	Unsupported
Call Hold	• Handling before the second call is established • Handling after the second call is established	Supported
Hotline and Warmline Service	• Hotline Immediate Service • Warmline Service (RSP / AS Provisioned) • Warmline Service (End-User Provisioned) – also known as Delayed Hotline	Supported
Distinctive Ringing	Ring Cadence • DR0 (default) • DR1 • DR3 • DR6 • DR7 * Does not support "alert-info" header in outgoing SIP INVITE requests	Supported
DTMF	• In-Band Transmission • Out-of-Band RFC2833 Transmission	Supported
Fax Support (supported)	• Fax pass-through	Supported

Fax Support (unsupported)	• T.38 / Fax over IP	Unsupported
Calling Line Identification Presentation / Restriction	• CLIP: Presentation: publish source number in outbound calls • CLIR: Restriction: keep source number private in outbound calls	Supported
Calling Number Display	• First incoming call • Second incoming call	Supported
Message Waiting Indication	• Visual Message Wait Indicator	Supported
Emergency Call	• Priority setting for outbound calls (SIP INVITE) • Deny other incoming call during emergency call	Supported
Voice Band Data (VBD) Call	• Pass-through using G.711 with fixed jitter buffer size • Fax up to 9.6 kbps • TTY support • Tone detection for the disablement of echo suppression and echo cancellation	Supported
Ringer Equivalence Number (REN)	• Up to 3 per UNI-V	Supported
3-Way Calling / Conferencing	• Local mixing of RTP traffic on the NTD	Unsupported
Call Transfer	• Attended (Consultative) call transfer and Unattended (Blind) call transfer	Unsupported
Voice Activity Detection (VAD)	• Reduces voice bandwidth when there is no audio activity • Comfort noise generation	Unsupported
Decadic / Pulse Diallers		Unsupported

3.4.3 Layer 3 Connectivity

It is the responsibility of Customer to manage allocation of IP addresses and associated network parameters to the SIP user agent associated with each UNI-V. DHCP is used as the mechanism to manage address distribution.

Customer must provide DHCP server infrastructure and assign the following parameters:

- IP Address (IPv4)
- Subnet Mask (Option 1)
- Default Router Address (IPv4) (Option 3)
- DNS server (required if a hostname is used for proxy server SIP URI) (Option 6)
- ACS Server

Within the Fibre Network, DHCP Option 82 fields will be populated with the identifier of the AVC associated with a given UNI-V, using a format described in the Network Interface Specification – AVC.

4 Access Virtual Circuit (AVC)

4.1.1 Overview

The AVC implements the C-VLAN component of an IEEE802.1ad Provider Bridge, as further described in the Network Interface Specification – AVC. Customer may deliver multiple End User applications (such as voice and video) using a single AVC (and CoS to manage the capacity between applications).

The **nbn**™ Ethernet AVC Product Component has three variants:

- Unicast 1:1 AVC – required for unicast data applications using the UNI-D or UNI-DSL
- Unicast N:1 AVC – required for unicast data applications using the UNI-V
- Multicast N:1 AVC – required for multicast data applications using the UNI-D, referred to as Multicast AVC

The AVC type availability is dependent on the access technologies and UNI types:

AVC Type	Fibre Network	FTTB Network / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
Unicast, 1:1[10]	Available on UNI-D	Available on UNI-DSL	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D
Unicast, N:1	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available
Multicast, N:1	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

AVCs are logically isolated from each other via the use of distinct S/C-VIDs, and are designed to be individually dimensioned by Customer from a set of selectable parameters according to the service needs of each End User.

An AVC is designed to be scaled in capacity (through its bandwidth profile), within the bounds of the product constructs and the physical limits of the underlying access network technology.

4.1.2 Access Loop Identification and Characterisation

Customer may optionally order a unicast AVC to have Access Loop Identification, and where applicable, Line Characteristic information inserted into DHCPv4, DHCPv6 and PPPoE upstream Layer 3 control packets in alignment with TR-101. This may assist Customer to identify the individual logical circuit to upstream devices beyond the NNI.

[10] One AVC inclusive of multiple traffic classes may be supported per UNI-D or UNI-DSL. Refer to Appendix B.

AVC information that can be included is:

- Access Loop Identification – identifying an **AVC Service ID.** The **AVC Service ID** means the value configured in the Circuit ID field in the relevant DHCPv4, DHCPv6 or PPPoE protocols.
- Access Loop Characterisation – identifying **actual data rate Upstream** and **actual data rate Downstream**

Access Loop Identification insertion is available on all access technologies subject to the control protocol used:

Control Protocol	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
DHCPv4	Available	Available	Available	Available	Available	Available
DHCPv6	Available	Available	Available	Available	Available	Not Available
PPPoE	Available	Available	Available	Available	Available	Available

Access Loop Characterisation insertion is only available on **nbn**™ Ethernet (FTTB) and **nbn**™ Ethernet (FTTN) and may be optionally included provided Access Loop Identification insertion is enabled:

Control Protocol	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
DHCPv4	Not Available	Available	Not Available	Not Available	Not Available	Not Available
DHCPv6	Not Available	Available	Not Available	Not Available	Not Available	Not Available
PPPoE	Not Available	Available	Not Available	Not Available	Not Available	Not Available

Detailed specifications for Access Loop Identification and Characterisation are set out in the Network Interface Specification – AVC.

4.1.3 AVC Bandwidth Profile Availability

4.1.3.1 Unicast 1:1 AVC Bandwidth Profile Availability

A Unicast 1:1 AVC comprises a combination of mandatory (TC-4) and optional (TC-1 and/or TC-2) traffic classes as described in section 3.1 of the **nbn**™ Ethernet Product Description subject to availability by access technology as set out in sections 3.2 to 3.4 of the **nbn**™ Ethernet Product Description.

A valid Unicast 1:1 AVC bandwidth profile comprises a combination of available upstream/downstream bandwidth profiles for each traffic class as specified from the available combinations in sections B.1 and B.2 to Appendix B. Availability by access technology for each Unicast 1:1 AVC bandwidth profile combination is also set out in sections B.1 and B.2 to Appendix B.

4.1.3.2 Unicast N:1 AVC Bandwidth Profile Availability

The Unicast N:1 AVC is available only to support the UNI-V and AVC TC-1 bundle as described in section 7 of the **nbn**™ Ethernet Product Description.

The available Unicast N:1 AVC bandwidth profile on the UNI-V is the combination of AVC TC-4 0/0 Mbps (PIR) and AVC TC-1 0.15Mbps (CIR).

4.1.3.3 Multicast AVC Bandwidth Profile Availability

The available Multicast (N:1) AVC bandwidth profiles comprise the TC-MC traffic class bandwidth profiles set out in section 5.3 of the **nbn**™ Ethernet Product Description as downstream only bandwidth in the TC-MC traffic class.

5 Connectivity Virtual Circuit (CVC)

5.1.1 Overview

The CVC implements the S-VLAN component of an IEEE802.1ad Provider Bridge, as further described in the Network Interface Specification - CVC. This is an Ethernet virtual circuit that provides connectivity from an NNI to a CSA. It is dimensioned with a specific, configured amount of bandwidth capacity to deliver a higher-layer service (or number of services) to a range of AVCs within a particular CSA.

The **nbn**™ Ethernet CVC Product Component has three variants:

- 1:1 VLAN – required for 1:1 AVC unicast services delivered using the UNI-D or UNI-DSL interface
- N:1 VLAN – required for N:1 AVC unicast services delivered using the UNI-V interface
- Multicast Domain – required for Multicast AVC services delivered through the UNI-D interface

The CVC type availability is dependent on the access technologies:

CVC Type	Fibre Network	FTTB / FTTN Network	FTTC Network	HFC Network	Wireless Network	Satellite Network
1:1 CVC	Available	Available	Available	Available	Available	Available
N:1 CVC	Available	Not Available	Not Available	Not Available	Not Available	Not Available
Multicast Domain	Available	Not Available	Not Available	Not Available	Not Available	Not Available

The NNI, and all CVCs delivered through it, are specific to Customer. It is possible that Customer may have multiple CVCs within a CSA delivered using a number of NNI. CVCs are isolated from each other on an NNI via the use of distinct S-VIDs and can each be individually dimensioned according to the service needs of each CSA and each AVC contained within the CVC. Subject to section 1.1(e) of the **nbn**™ Ethernet Product Description, different CVC types (including the Multicast Domain) are able to co-exist on the same NNI.

5.1.2 AVC and CVC Scalability

Customer should consider AVC and CVC scalability in conjunction with contention. Customer may control End User experience through contention applied by dimensioning of capacity between the AVC and CVC subject to conditions set out in the **nbn**™ Ethernet Product Description.

5.1.2.1 Unicast 1:1 CVC Scalability

A single unicast 1:1 CVC can support up to 4,000 unicast 1:1 AVCs, and is able to deliver AVCs to any UNI within a single CSA.[11] Each of the 4,000 unicast 1:1 AVCs is addressed using a single, unique C-VID, locally significant to the CVC. Subject to section 2.1(d) of the **nbn**™ Ethernet Product Description, the number of CVCs that Customer may purchase in relation to a given CSA is limited only by the NNI resources that Customer has purchased for that CSA. Note that where Customer requires access to more than 4,000 AVCs in a given CSA, it is necessary to utilise more than one CVC.

5.1.2.2 Unicast N:1 CVC Scalability

As Unicast N:1 does not use C-VLANs there is no restriction on the number of unicast N:1 AVCs within a CSA that can be associated with a single unicast N:1 CVC at the NNI.

5.1.2.3 Multicast Domain Scalability

There are no restrictions on the number of Multicast AVCs within a CSA that can be associated with a single Multicast Domain at the NNI.

5.1.3 CVC Bandwidth Profile Availability

5.1.3.1 Unicast 1:1 CVC Bandwidth Profile Availability

The available unicast 1:1 CVC bandwidth profiles comprise a combination of available upstream/downstream bandwidth profiles for each traffic class as defined in sections 2.2 to 2.4 of the **nbn**™ Ethernet Product Description, provided that the total combination of CVC bandwidth profiles is not zero. Those sections set out additional limitations that apply in respect of **nbn**™ Ethernet (Satellite).

5.1.3.2 Unicast N:1 CVC Bandwidth Profile Availability

The available unicast N:1 CVC bandwidth profiles comprise the TC-1 traffic class bandwidth profiles set out in section 2.3(b) of the **nbn**™ Ethernet Product Description.

5.1.3.3 Multicast Domain Bandwidth Profile Availability

The available Multicast Domain bandwidth profiles comprise the TC-MC traffic class bandwidth profiles set out in section 5.2(a) of the **nbn**™ Ethernet Product Description.

Customer must select a bandwidth profile for each Multicast Domain taking into account the aggregated peak bandwidth requirements of each of the Media Streams in the Multicast Domain as described in section 2.3.3.1.

[11] Note that **nbn**™ Ethernet (Satellite) is supplied in a separate single national CSA which geographically overlaps with the other CSAs that contain Premises served by other **nbn**™ Network technologies.

5.1.4 CVC Contention Management

Subject to section 2.1(d) of the **nbn**™ Ethernet Product Description, Customer should control AVC:CVC contention for the purpose of managing service utilisation. In the event of AVC:CVC congestion within unicast services, the **nbn**™ Network will discard traffic in accordance with section 2.2.

6 Network-Network Interface (NNI)

Section 1 of the **nbn**™ Ethernet Product Description describes the NNI Product Component and the NNI Group and NNI Bearer entities and their interrelationships. This section provides further product-level specification of the NNI Group, NNI Bearers, Redundancy Mode and the CVC support characteristics of the NNI Product Component.

Detailed network-level specifications are set out in the Network Interface Specification – NNI.

6.1 NNI Group and NNI Bearers

An NNI Group can support up to 8 NNI Bearers[12]. All NNI Bearers within an NNI Group must be consistent with the group interface rate for that NNI Group[13] (i.e. 1Gbps, or 10Gbps).

6.2 Redundancy Mode

The NNI Group must be configured in one of the following redundancy modes:

- **Single Chassis** (where all NNI Bearers are connected to the same EFS chassis)
- **Diverse Chassis** (where NNI Bearers are connected across a pair of EFS chassis)

6.2.1 Single Chassis

When an NNI Group is configured in Single Chassis mode, all NNI Bearers of the NNI Group will be provisioned on the same EFS chassis.

These NNI Bearers will operate in an N:1 protection mode, meaning that if any NNI Bearer within the NNI Group fails, the NNI Group will continue to operate at an aggregate capacity that is reduced by the capacity of the failed NNI Bearer.

6.2.2 Diverse Chassis

When an NNI Group is configured in Diverse Chassis mode, half of the NNI Bearers of the NNI Group will be provisioned on one EFS (working) chassis, and the other half will be provisioned on a second EFS (protect) chassis.

The NNI Group will operate in a 1:1 protection mode, meaning that if any NNI Bearer on the working EFS fails, traffic will be re-directed to the NNI Bearers on the protect EFS chassis.

[12] Note that the addition of NNI Bearers to an NNI Group may result in the degradation of aggregate NNI Group link efficiency, as a result of IEEE802.3ad frame distribution.

[13] Optical characteristics may vary, providing the interface rate is consistent.

6.3 CVC Support

An NNI Group can support up to 4,000 CVCs in aggregate, including (subject to section 1.1(e) of the **nbn™** Ethernet Product Description) any mix of CVC types and Multicast Domains.

Customer is not permitted to over-book CVC capacity within an NNI Group.

6.4 Class of Service Support

The NNI Group will transparently support the traffic class and priority encoding/decoding model set out in section 2.2 and 3.1.2 and detailed in section 3 of the Network Interface Specification – CVC.

For NNI Groups configured as Single Chassis, the failure of one or more NNI Bearers may result in the discard of traffic due to insufficient NNI Group aggregate capacity to carry the provisioned CVC capacity. In such cases, traffic is designed to be discarded according to the priority as indicated at the CVC level.

7 Network Performance

7.1 Traffic Class Performance

nbn will aim to achieve the following standards (on an individual traffic class basis) for each traffic class:

Traffic Class	Network	Frame Delay (One-Way)	Frame Delay Variation	Frame Loss[14]
TC-1	Fibre Network	≤ 6msec	≤ 3msec	≤ 0.01%
	FTTB Network FTTN Network	≤ 25msec	≤ 10msec	≤ 0.04%
	FTTC Network	≤ 25msec	≤ 10msec	≤ 0.04%
	HFC Network	≤ 25msec	≤ 10msec	≤ 0.04%
	Wireless Network	≤ 40msec	≤ 50msec	≤ 0.04%
	Satellite Network	≤ 370msec	≤ 25msec	≤ 0.04%
TC-2	Fibre Network	≤ 6msec	≤ 10msec	≤ 0.01%
	FTTB Network FTTN Network	≤ 25msec	≤ 16msec	≤ 0.04%
	FTTC Network	≤ 25msec	≤ 16msec	≤ 0.04%
TC-MC	Fibre Network	Unspecified	≤ 10msec	≤ 0.01%
TC-4	Not Applicable	Not Applicable	Not Applicable	Not Applicable

7.2 Limitations on the Standards for Traffic Class Operations Performance

The performance of traffic class operations as specified in section 7.1 will only apply under the following conditions:

Traffic Class	Layer 2 Frame Size at NNI (Bytes)[15]	Frame Rate	CVC Traffic Class Capacity Utilisation
TC-1	250	Periodic <=CIR	≤ 70%
TC-2	1500	Periodic <=CIR	≤ 70%
TC-MC	1526	Not Applicable	≤ 70%[16]

[14] Frame Loss targets will only be met where the CBS is less than the specified limits at both the AVC and CVC level as described in section 2.2.2.2 and any applicable Network Interface Specification.

[15] Service frames are accepted up to the maximum Frame Size as described in section 3.4 of the Network Interface Specification – NNI.

[16] Note that individual Media Streams must operate within their configured peak bandwidth.

Frame Delay guidance is provided between UNI and NNI distances less than 100km. In the case of UNI to NNI distance > 100km, an extra allowance of 1.4msec latency per additional 200km air path (as the crow flies) distance (or part thereof) is required.

The performance of traffic class operations does not apply to:

- services utilising the UNI-V over the Fibre Network because they are subject to additional performance-affecting processing which will impact end-to-end performance
- **nbn**™ Ethernet (FTTB) Ordered Products or **nbn**™ Ethernet (FTTN) Ordered Products, where the Line Rate is not capable of supporting the provision of all AVC TC-1 and AVC TC-2 bandwidth profiles ordered by Customer in respect of that Ordered Product (see section 3.3.2)
- **nbn**™ Ethernet (FTTC) where the Access Line Rate or the Line Rate of the UNI-D is not capable of supporting the provision of all AVC TC-1 and AVC TC-2 bandwidth profiles ordered by Customer in respect of that Ordered Product (see section 3.2.2).

The Layer 2 Frame Size and Frame Rate values must result in a data stream which is less than or equal to the subscribed Traffic Class CIR or any other circumstance in which the speed, performance or stability of an Ordered Product is affected by any matters set out in sections 3 or 13 of the **nbn**™ Ethernet Product Description.

Each traffic class must be validated in the presence of no other traffic from other traffic classes within the AVC.

7.3 TC-4 Traffic Performance Characteristics

Traffic class 4 is designed for applications that can benefit from a peak capacity and can tolerate variable throughput. TC-4 offers capacity as a PIR only.

The performance of Customer Products that use AVC TC-4s as an input will vary depending on factors both within and outside of the **nbn**™ Network. Customer should use suitable higher-layer intelligent flow control mechanisms to achieve optimum results for Customer Products that use AVC TC-4s as an input. The particular access technology used to deliver **nbn**™ Ethernet will also have an impact on TC-4 performance.

For AVC TC-4 bandwidth profiles of 250/100 Mbps, 500/200 Mbps and 1000/400 Mbps offered over **nbn**™ Ethernet (Fibre) where a 10Gbps NNI is in use, an AVC peak burst in excess of 100 consecutive Ethernet frames may cause increased Frame Loss in the downstream if Customer does not use a suitable higher-layer intelligent flow control mechanism.

8 Orderable Attributes

8.1 Access Components

Access Components, for the purposes of this **nbn**™ Ethernet Product Technical Specification, only comprise each instance of the UNI and AVC Product Components supplied by **nbn** to Customer to use as an input to a Customer Product or Downstream Product.

Available Product Components are tabled below:

	UNI Type	Available associated AVC
Fibre Network	UNI-D	Unicast Multicast
	UNI-D + UNI-V	Unicast (separately with each UNI-D and UNI-V) Multicast (UNI-D only)
Wireless Network	UNI-D	Unicast
HFC Network	UNI-D	Unicast
FTTC Network	UNI-D	Unicast
Satellite Network	UNI-D	Unicast
FTTB Network / FTTN Network	UNI-DSL	Unicast

Each Access Component is delivered using two sets of attributes:

- **configuration attributes** – provided through Product Templates
- **service attributes** – provided through Product Order Forms for each AVC order[17]

This section describes the Access Components in the context of configuration and service attributes.

8.1.1 Configuration Attributes

The following tables detail all AVC and UNI attributes which must be specified within a Product Template, for the delivery of the relevant Access Components.

Customer may construct its end-to-end service from a combination of these configuration attributes and service attributes selected in relation to each Ordered Product.

[17] The term "service attributes" is used to describe the technical elements which are required to deliver Product Features as described in the **nbn**™ Ethernet Product Description and elsewhere in this **nbn**™ Ethernet Product Technical Specification.

Certain settings required to interface to the **nbn**™ Network must be decided at time of On-boarding during the solution definition phase, and captured in a Product Template. These details cannot be tailored for each specific Ordered Product.

Product Templates apply to the Access Components only. Product Templates, combined with per-Ordered Product service attributes selected in a Product Order Form at time of order, are required for **nbn** to supply an Ordered Product.

8.1.1.1 UNI Configuration Attributes

The following set of configuration attributes are available for the UNI. These parameters are captured during the solution definition phase, as part of the On-boarding process.

Component	Configuration Attribute	Configuration Attribute Options
UNI	UNI Type	UNI-D
		UNI-DSL
		UNI-V (only available for **nbn**™ Ethernet (Fibre))
	VLAN Addressing Mode	Default-Mapped (UNI-D/UNI-DSL only)[18]
		DSCP-Mapped
		Priority-Tagged (UNI-D/UNI-DSL only)
		Tagged (UNI-D/UNI-DSL only)

Table 2: UNI Configuration Attributes

8.1.1.2 AVC Configuration Attributes

The following set of configuration attributes are available for the AVC (and Multicast AVC). These parameters are captured during the solution definition phase, as part of the On-boarding process.

Component	Configuration Attribute	Configuration Attribute Options
AVC	AVC Type	Unicast 1:1 (UNI-D/UNI-DSL only)
		Unicast N:1 (UNI-V only)
		Multicast N:1 (UNI-D for **nbn**™ Ethernet (Fibre))
	Bandwidth Profile	Specified from the available bandwidth profiles in Appendix B

Table 3: AVC Configuration Attributes

[18] Note the limitations on addressing mode and AVC traffic class combinations in Appendix B.

8.1.2 Service Attributes

This section describes the service attributes relating to the technical operation of the service that Customer must select for each Access Component, at the time of ordering an Ordered Product. Note that the number and type of service components will be determined by the Product Template.

8.1.2.1 Access Component Attributes

The following service attributes must be specified, where applicable, at time of order for each AVC (or Multicast AVC) and UNI Product Component:

Component	Service Attribute	Specification (Provided by Customer)
Access Service[19]	"Service Restoration SLA" (Service Fault rectification Service Level)	Standard (Default)
		Enhanced-12
		Enhanced-12 (24/7)
		Enhanced-8
		Enhanced-8 (24/7)
		Enhanced-6
		Enhanced-6 (24/7)
		Enhanced-4
		Enhanced-4 (24/7)
	Priority Assist (Downstream Priority Assistance Service)	No (Default)
		Yes
	Battery Backup Service	Yes[20]
		No

Table 4: Service Attributes for Access Service

8.1.2.2 UNI-V Service Attributes

The following service attributes must be specified at time of order for the UNI-V (for **nbn**™ Ethernet (Fibre) only):

Component	Service Attribute	Specification (Provided by Customer)
UNI-V	NTD UNI-V Port Number	0: Assigned by **nbn** (default)

Table 5: Service Attributes for UNI-V

[19] Refer to the **nbn**™ Ethernet Service Levels Schedule and the **nbn**™ Ethernet Product Description for details of supported service options that are available.

[20] Where Customer has specified the Battery Backup Service in respect of an Ordered Product supplied to a UNI on the affected F-NTD, **nbn** will provide a notification of the alarm to Customer as set out in the WBA Operations Manual as part of the Battery Backup Service.

8.1.2.3 UNI-D Service Attributes

The following service attributes must be specified at time of order for the UNI-D:

Component	Service Attribute	Specification (Provided by Customer)
UNI-D	NTD UNI-D Port Number	0: Assigned by **nbn** (default) 1 – 4: Request Specific UNI-D Port on NTD (if > 1 available)
	FTTC-NCD UNI-D Port Number	0: Assigned by **nbn** (default): Note this attribute cannot be specified by Customer.
	Physical Interface	AUTO (Speed)/AUTO (Duplex)
		100Mbps/AUTO (Duplex)[21]

Table 6: Service Attributes for UNI-D

8.1.2.4 UNI-DSL Service Attributes

The following DSL service attributes must be specified at time of order:

Component	Service Attribute	Specification (Provided by Customer)
UNI-DSL	DSL Stability Profile[22]	Standard - means the standard VDSL2 line profile.
		Stable - means a VDSL2 line profile designed to optimise layer 1 stability, for example through an increased noise margin and G.Inp retransmission buffer.

Table 7: Service Attributes for UNI-DSL

Note that DSL Mode is VDSL2 and cannot be changed.

8.1.2.5 Unicast AVC Service Attributes

The following service attributes must be specified at time of order for each unicast 1:1 AVC:

Component	Service Attribute	Specification (Provided by Customer)
AVC	CVC ID	CVC ID

[21] This specification is not available for **nbn**™ Ethernet (Satellite).

[22] Note that **nbn** may apply a Repair Profile as described in the WBA Operations Manual. This profile is applied by **nbn** and is not selectable by Customer.

Component	Service Attribute	Specification (Provided by Customer)
	C-VID at NNI (1:1 AVC only)	0 – 4000[23]
	C-VID at UNI-D/UNI-DSL[24] (1:1 AVC only)	2 – 4004 (for **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (FTTB), **nbn**™ Ethernet (FTTN), **nbn**™ Ethernet (FTTC) and **nbn**™ Ethernet (HFC)) 2 – 4001 (for **nbn**™ Ethernet (Wireless) and **nbn**™ Ethernet (Satellite))
	Bandwidth Profile	Specified from the available unicast AVC bandwidth profiles in Appendix B
	Access Loop Identification Active	Active / Inactive
		If Active Insert DSL line rate (used in DHCP or PPP response [RFC 4679 support]) (for **nbn**™ Ethernet (FTTB) and **nbn**™ Ethernet (FTTN) only)
	TPEP Web Optimisation[25] (**nbn**™ Ethernet (Satellite) only)	ON (Default) / OFF
	TPEP TCP Optimisation (**nbn**™ Ethernet (Satellite) only)	ON (Default) / OFF
	Interface mode	Default-Mapped / Priority-Tagged / Tagged / DSCP Mapped

Table 8: Service Attributes for Unicast 1:1 AVC

The following service attributes must be specified at time of order for each unicast N:1 AVC:

Component	Service Attribute	Specification (Provided by Customer)
AVC	CVC ID	CVC ID

Table 9: Service Attributes for Unicast N:1 AVC

8.1.2.6 Modification of an AVC bandwidth profile and service interruption

Customer may modify an AVC TC-4 bandwidth profile in accordance with the WBA Operations Manual. There will be a brief service interruption when the Modify Order is processed.

[23] The value of zero indicates that **nbn** will select the C-VID, and does not indicate that a C-VID of zero may be used.

[24] Required only for UNI-D/UNI-DSL mode configured in Tagged mode.

[25] Selecting TPEP Web Optimisation will also enable TPEP TCP Optimisation.

8.1.2.7 Multicast AVC Service Attributes

The following service attributes must be specified at time of order for each multicast AVC:

Component	Service Attribute	Specification (Provided by Customer)
AVC	Multicast Domain ID	Multicast Domain ID
	Bandwidth Profile	Specified from the available Multicast AVC bandwidth profiles in Appendix B

Table 10: Service Attributes for Multicast AVC

8.2 CVC Service Attributes

There is no Product Template required for a CVC. Table 11 describes the set of service attributes which are generic to all CVC variants (except where called out specifically).

Component	Attributes	Attribute Description	Selectable Options
End-Point Identification	NNI Group identification[26]	Identification of the NNI that the CVC is to be terminated on.	NNI Group identification (Existing)
	B-END CSA	Identification of the CSA that the CVC is terminated on.	CSA identification[27]
S-TAG Mapping	S-TAG (NNI)	Customer may choose a locally-significant S-TAG at the NNI. Optional parameter. If set to zero, **nbn** will assign the next available value.	Requested S-TAG (0 for **nbn**-supplied S-TAG) Default = 0 S-TAG: (1 – 4000)
Satellite CVC Minimum AVC threshold (**nbn**™ Ethernet (Satellite))	CVC Class	Customer must choose this attribute at the time of ordering a CVC for **nbn**™ Ethernet (Satellite). This attribute determines the minimum number of provisioned AVCs required before Customer can order an increased CVC bandwidth profile.[28]	CVC Class-0 (Default) CVC Class-1 (Premium) CVC Class-2 (Premium)

Table 11: Generic CVC Service Attributes

[26] Refer to section 8.4 of this **nbn**™ Ethernet Product Technical Specification.

[27] **nbn**™ Ethernet (Satellite) operates from a single centralised POI and covers the entire Satellite Network footprint as a single CSA.

[28] See the **nbn**™ Ethernet Product Description for further details.

The allocation of S/C-VID values at the NNI must be co-ordinated between Customer and **nbn**.

When requested by Customer as part of a Product Order Form for a CVC or AVC, **nbn** will allocate each new CVC/AVC an internally-generated S/C-VID. This S/C-VID value will be returned to Customer in accordance with the WBA Operations Manual, and must be used for accessing the CVC/AVC at the NNI.

Customer may optionally elect to nominate the S/C-VID used to address each CVC/AVC service instance through the NNI by specifying a S/C-VID in the Product Order Form for the CVC/AVC, for the purpose of further alignment to its own backhaul network addressing schemes. Note that Customer is encouraged to use **nbn**'s S/C-VID allocations, which will be unique to Customer's service. This will avoid any potential for S/C-VID mismatch between Customer and **nbn**.

For service addressing modes at the NNI that rely on MAC addressing for forwarding within the **nbn**™ Network, the allocation of a C-VID is not required.

8.2.1 Unicast 1:1 CVC

Each unicast 1:1 CVC order must specify each of the service attributes listed in Table 12 below, in addition to those configuration attributes detailed in Table 11.

Component	Attributes	Attribute Description	Selectable Options
Bandwidth profile	Bandwidth profile	CVC_TC-1_CIR (upstream and downstream)	Refer to Appendix B
		CVC_TC-2_CIR (upstream and downstream)	Refer to Appendix B
		CVC_TC-4_CIR (upstream and downstream)	Refer to Appendix B

Table 12: 1:1 Unicast CVC Additional Service Attributes

8.2.2 Unicast N:1 CVC

Each unicast N:1 CVC order must specify each of the service attributes listed in Table 13 below, in addition to those configuration attributes detailed in Table 11.

Component	Attributes	Attribute Description	Selectable Options
Bandwidth profile	Bandwidth profile	CVC_TC-1_CIR (upstream and downstream)	Refer to Appendix B

Table 13: N:1 Unicast CVC Additional Service Attributes

8.2.3 Multicast Domain

Each Multicast Domain order must specify each of the service attributes listed in Table 14 below, in addition to those configuration attributes detailed in Table 11.

Component	Attributes	Attribute Description	Selectable options
Bandwidth Profile	Bandwidth Profile	CVC_TC-MC_CIR (downstream)	Refer to Appendix B
Multicast Options	Media Stream List	Details of Media Streams carried by the Multicast Domain.	Refer to section 8.3
	IGMP Report Source Address	Source address inserted by **nbn** for IGMP report messages sent upstream on the Multicast Domain.	IP Address Default = 49.0.15.254

Table 14: Multicast Domain Additional Service Attributes

8.3 Multicast Domain Media Stream Attributes

The following information is required to capture the characteristics of each Media Stream to be carried within the Multicast Domain.

Identifier	Multicast Group IP Address	Peak Bandwidth (Mbps)
<TEXT>	IP Address	Value : 2.5 – 20
<TEXT>	IP Address	Value : 2.5 – 20
...	...	...
<TEXT>	IP Address	Value : 2.5 – 20

Table 15: Media Stream List Description Table (Multicast Domain)

The <TEXT> field is provided to allow Customer to reference each Media Stream using a meaningful name, and has a limit of 40 characters.

Customer must be aware of transition periods when modifying certain attributes associated with the Multicast Domain or Media Stream as described in the **nbn**™ Ethernet Service Levels Schedule and the WBA Operations Manual. As modification may occur progressively over geographic areas Customer will need to operate upstream components of an end-to-end service (in the Customer Network) with a mixture of “before” and “after” configurations until the modification is completed.

8.4 NNI Service Attributes

8.4.1 NNI Group

The NNI Group has the following attributes:

- Location
- Interface Rate
- Redundancy Mode
- Set of NNI Bearers
- Layer 2 Functional Characteristics

8.4.1.1 NNI Group Location

The location of the NNI Group must be specified at time of NNI Group creation.

In order to change the location of an NNI Group (i.e. re-locate NNI Bearers to a different location), it is necessary to purchase a new NNI Group in the intended location, and transition existing AVCs and CVCs from the previous NNI Group. Once completed, the previous NNI Group may be cancelled.

8.4.1.2 NNI Group Interface Rate

A new NNI Group will be configured with a group interface rate that determines the interface rate of each NNI Bearer within the NNI Group. The following group interface rates are available:

- 1Gbps
- 10Gbps

The group interface rate is set through the selection of the first NNI Bearer (Single Chassis mode), or pair of NNI Bearers (Diverse Chassis mode) at the time the NNI Group is created (each mode is described in section 6).

The group interface rate is fixed per NNI Group and will restrict the type of NNI Bearer that can be added to the NNI Group. For example, if the NNI Group is created with an initial NNI Bearer operating at 1Gbps, then any further NNI Bearers added to this group must also have an interface rate of 1Gbps.

In order to change the group interface rate of an NNI Group (i.e. change all 1Gbps NNI Bearers to 10Gbps), it is necessary to purchase a new NNI Group in the intended group interface rate and associated NNI Bearers, and transition existing AVCs and CVCs from the previous NNI Group. Once completed, the previous NNI Group may be cancelled by Customer.

8.4.1.3 NNI Group Redundancy Mode

The NNI Group must be configured in one of the following redundancy modes:

- **Single Chassis** (where all NNI Bearers are connected to the same EFS chassis)
- **Diverse Chassis** (where NNI Bearers are connected across a pair of EFS chassis)

In order to change the redundancy mode of an NNI Group, Customer must purchase a new NNI Group in the intended redundancy mode and transition existing AVCs and CVCs from the previous NNI Group. Once completed, the previous NNI Group may be cancelled.

8.4.1.4 NNI Group Orderable Attributes Summary

A summary of attributes that must be specified for each NNI Group order is shown in Table 16.

Component	Attributes	Attribute Description	Selectable Options
Service details	Physical Location	Physical location of NNI	POI Site
NNI Group Attributes	TPID	Ability to specify the S-TAG TPID used for service frames across the NNI	0x88A8 (default)
			0x8100
	Redundancy Mode	Physical interface type	Single Chassis (default)
			Diverse Chassis

Table 16: NNI Group Orderable Attributes

Each successful NNI Group order is intended to yield an **nbn**-supplied NNI Group identification.

8.4.2 NNI Bearer

8.4.2.1 NNI Bearer Ordering

NNI Bearers are ordered through an NNI Group (refer to section 6).

A feasibility check will be required upon addition of any NNI Bearer to a NNI Group, to determine whether the number of allowable NNI Bearers within the NNI Group has been exceeded.

nbn initially provisions each completed NNI Bearer order to Customer in an administratively "down" state. **nbn** will change this to an "up" state in co-ordination with Customer.

The following activities may be performed on an NNI Group, with respect to the set of NNI Bearers:

- establish a new NNI Group through ordering at least one NNI Bearer (Single Chassis mode) or at least one pair of NNI Bearers (Diverse Chassis mode)
- modify an existing NNI Group through adding/removing NNI Bearer(s)
- cancel an existing NNI Group – all underlying NNI Bearers will be automatically cancelled

For NNI Groups configured as Single Chassis, NNI Bearers may be ordered as single interfaces.

For NNI Groups configured as Diverse Chassis, NNI Bearers must be ordered in pairs, with each NNI Bearer of each pair provisioned on different EFS.

For NNI Groups comprising 1Gbps Ethernet interfaces, **nbn** intends to use reasonable endeavours to provide the ability to seamlessly scale an NNI Group up to four NNI Bearers. Beyond four NNI Bearers, **nbn** intends to schedule an Outage with Customer unless **nbn** notifies Customer that an Outage is not necessary.

For NNI Groups comprising 10Gbps Ethernet interfaces, **nbn** intends to schedule an Outage with Customer in order to augment the NNI Group with additional NNI Bearers unless **nbn** notifies Customer that an Outage is not necessary.

8.4.2.2 NNI Bearer Orderable Attributes

Each NNI Bearer order must specify each of the service attributes listed in Table 17.

Component	Attributes	Attribute Description	Selectable Options
Service details	NNI Group	The NNI Group to which the NNI Bearer is intended to be associated	NNI Group identification
NNI Bearer	Type	Physical interface type	1000BaseLX
			1000BaseEX
			10GBaseLR
			10GBaseER

Table 17: NNI Bearer Service Attributes

Each successful NNI Bearer order will yield an **nbn**-supplied NNI Bearer identification, which will indicate a physical port on the **nbn** ODF to which the NNI Bearer has been cabled.

Customer must separately acquire the necessary facilities access rights to connect the NNI Bearer to Customer's backhaul transmission cables or Customer Active Equipment.

Appendix A Access Technology Compatibility

nbn supplies the **nbn**™ Ethernet by means of:

- the Fibre Network (using fibre (GPON) technology);
- the FTTB Network or the FTTN Network or the FTTC Network (using copper xDSL technology);
- the HFC Network (using Hybrid Fibre Coaxial technology);
- the Wireless Network (using fixed wireless technology);
- the Satellite Network (using geo synchronous satellite technology); and

as further described in the **nbn**™ Ethernet Product Description.

Any service supplied by **nbn** in respect of a Premises may be supplied using any **nbn**™ Network as described in this Product Technical Specification. The network which will be used will be determined by **nbn**, based on the location of the Premises. **nbn** will determine what Product Components, Product Features and level of performance can be offered.

This section describes the restrictions on the availability and differences in performance of Product Features.

A.1 Service Type Availability

This section describes the availability of features described in section 2.1.

Service Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Unicast data services	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
IP-based telephony services (External ATA)	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
IP-based telephony services (Integrated ATA)	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available
Multicast services	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

Table 18: Service Type Availability by nbn™ Network

A.2 Product Feature Availability

A.2.1 Service Level Options

This section describes the availability of features described in section 8.1.2.1.

Service Level Option	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Service Fault Rectification – standard	Available	Available	Available	Available	Available	Available
Service Fault Rectification–Enhanced-12	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-12 (24/7)	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-8	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-8 (24/7)	Available	Not Available	Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-6	Available	Not Available	Not Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-6 (24/7)	Available	Not Available	Not Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-4	Available	Not Available	Not Available	Available	Not Available	Available
Service Fault Rectification–Enhanced-4 (24/7)	Available	Not Available	Not Available	Available	Not Available	Available
Downstream Priority Assistance Service	Available	Not Available	Available	Available	Not Available	Available

Table 19: Service Level Option Availability by nbn™ Network

A.3 NNI Availability

The NNI Product Component as described in section 6 is available across the **nbn**™ Network.[29] There are no restrictions in the ability to deliver NNI features as a result of the type of **nbn**™ Network.

[29] NNI availability in respect of **nbn**™ Ethernet (Satellite) is limited to a single centralised POI located in Eastern Creek, NSW, and is subject to section 1.1(e) of the **nbn**™ Ethernet Product Description.

A.4 CVC Availability

This section describes the availability of features as described in section 5.

CVC Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/N
1:1 Unicast	Available	Available	Available	Available	Available	Available
N:1 Unicast	Available	Not Available	Not Available	Not Available	Not Available	Not Available
Multicast Domain	Available	Not Available	Not Available	Not Available	Not Available	Not Available

Table 20: CVC Type Availability by nbn™ Network

A.5 UNI Feature Availability

A.5.1 UNI Type Availability

UNI Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
UNI-D	Up to 4 UNI-D per NTD[30]	Up to 4 UNI-D per NTD[31]	1 UNI-D per NTD[32]	1 UNI-D per FTTC-NCD	Up to 4 UNI-D per NTD[33]	Not Available
UNI-DSL	Not Available	Not Available	Not Available	Not Available	Not Available	One single UNI-DSL port (not on an NTD)
UNI-V	Up to 2 UNI-V per NTD	Not Available	Not Available	Not Available	Not Available	Not Available

Table 21: UNI Type Availability by nbn™ Network

A.5.2 Addressing Mode Availability

UNI Mode	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
Default-Mapped TC-4	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Default-Mapped TC-1	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Default-Mapped TC-2	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL

[30] See the **nbn**™ Ethernet Product Description and the **nbn**™ Ethernet Fair Use Policy for limitations on UNI availability on certain **nbn** Network types.

[31] See the **nbn**™ Ethernet Product Description and the **nbn**™ Ethernet Fair Use Policy for limitations on UNI availability on certain **nbn** Network types.

[32] Although the CM8200B variant of the HFC-NTD is physically equipped with two UNI-D ports (UNI-D1 and UNI-D2), only UNI-D1 port is available for use at this point in time. Typically, the UNI-D2 port will be covered with a sticker.

[33] See the **nbn**™ Ethernet Product Description and the **nbn**™ Ethernet Fair Use Policy for limitations on UNI availability on certain **nbn** Network types.

DSCP-Mapped	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Priority-Tagged	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
Tagged	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

Table 22: Addressing Mode Availability by nbn™ Network

A.6 AVC Feature Availability

A.6.1 AVC Type

This section describes the availability of features described in section 4.

AVC Type	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
1:1 Unicast	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
N:1 Unicast	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available
Multicast	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

Table 23: AVC Feature Availability – AVC (and Multicast AVC) Type by nbn™ Network

A.6.2 Access Loop Identification

This section describes the availability of the Access Loop Identification feature for unicast AVCs (described in section 4.1.2).

AVC Traffic Class	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
IPv4 DHCP Option 82	Available on UNI-D Available on UNI-V	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
IPv6 DHCP Option 18	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
IPv6 DHCP Option 17	Not Available	Not Available	Not Available	Not Available	Not Available	Available on UNI-DSL
PPPoE IA Insertion	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

Table 24: AVC Feature Availability – Access Loop Identification by nbn™ Network

A.6.3 Bandwidth Profile - Traffic Class

This section describes restrictions on the availability of a traffic class according to access technology.

AVC Traffic Class	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
TC-1	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

	Available on UNI-V					
TC-2	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
TC-MC[34]	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
TC-4	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL

Table 25: AVC Feature Availability – Traffic Class by nbn™ Network

A.6.4 Bandwidth Profile – Unicast 1:1 AVC TC-1

This section describes restrictions on the availability of AVC TC-1 bandwidth profiles (described in section 4.1.3.1) according to access technology.

Bandwidth Profile (TC-1)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
0.15 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
0.3 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
0.5 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
1Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
2Mbps	Available on UNI-D	Not Available	Available on UNI-D	Available on UNI-D	Not Available	Available on UNI-DSL
5Mbps	Available on UNI-D	Not Available	Available on UNI-D[35]	Available on UNI-D	Not Available	Available on UNI-DSL

Table 26: Unicast 1:1 AVC Feature Availability – Bandwidth Profile (TC-1) by nbn™ Network

A.6.5 Bandwidth Profile – Unicast N:1 AVC TC-1

This section describes restrictions on the availability of TC-1 AVC bandwidth profiles (described in section 4.1.3.2) according to access technology.

Bandwidth Profile (TC-1)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0.15 Mbps	Available on UNI-V	Not Available	Not Available	Not Available	Not Available	Not Available

[34] Delivered through a dedicated Multicast AVC only.

[35] The CM820B variant of the HFC-NTD does not support the TC-1 5Mbps bandwidth profile.

Table 27: Unicast N:1 AVC Feature Availability – Bandwidth Profile (TC-1) by nbn™ Network

A.6.6 Bandwidth Profile – Unicast 1:1 AVC TC-2

This section describes restrictions on the availability of AVC TC-2 bandwidth profiles (described in section 4.1.3.1) according to access technology.

Bandwidth Profile (TC-2)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0 Mbps	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
5 Mbps	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
10 Mbps	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
20 Mbps	Available on UNI-D	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
30 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
40 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
50 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
60 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
70 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
80 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
90 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
100 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

Table 28: Unicast 1:1 AVC Feature Availability – Bandwidth Profile (TC-2) by nbn™ Network

A.6.7 Bandwidth Profile - Multicast N:1 AVC

This section describes restrictions on the availability of Multicast N:1 AVC TC-MC bandwidth profiles (described in section 4.1.3.3) according to access technology.

Bandwidth Profile (TC-MC)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
5 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
20 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
30 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

40 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
50 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

Table 29: Multicast AVC Feature Availability – Bandwidth Profile by nbn™ Network

A.6.8 Bandwidth Profile – Unicast 1:1 AVC TC-4

This section describes restrictions on the availability of unicast 1:1 AVC TC-4 bandwidth profiles (described in section 4.1.3.1) according to access technology.

Bandwidth Profile (TC-4)	Fibre	Wireless	HFC	FTTC	Satellite	FTTB/FTTN
0 Mbps	Available subject to UNI-V order being in place[36]	Not Available	Not Available	Not Available	Not Available	Not Available
12/1 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
25/5 Mbps	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-D	Available on UNI-DSL
25/5-10 Mbps	Not Available	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
25/10 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Not Available	Not Available
50/20 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Not Available	Not Available
25-50/5-20 Mbps	Not Available	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
25-100/5-40 Mbps	Not Available	Not Available	Not Available	Available on UNI-D	Not Available	Available on UNI-DSL
100/40 Mbps	Available on UNI-D	Not Available	Available on UNI-D	Not Available	Not Available	Not Available
250/100 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
500/200 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available
1000/400 Mbps	Available on UNI-D	Not Available	Not Available	Not Available	Not Available	Not Available

Table 30: AVC Feature Availability – Bandwidth Profile (TC-4) by nbn™ Network

[36] Upon order of the UNI-V by Customer, the UNI-V is automatically provisioned by **nbn** with TC-1 capacity. A TC-4 bandwidth profile of 0 Mbps can only be ordered when a UNI-V is provisioned with associated TC-1 capacity.

Note: To be read subject to section 2.2.2 of this **nbn**™ Ethernet Product Technical Specification and section 13.3 of the **nbn**™ Ethernet Product Description.

Appendix B Traffic Class Combinations

The bandwidth profiles in this Appendix B are subject to the specifications and limitations described in this **nbn**™ Ethernet Product Technical Specification the **nbn**™ Ethernet Product Description.

B.1 Unicast 1:1 AVC Bandwidth Profiles for nbn™ Ethernet (Fibre), nbn™ Ethernet (Wireless), nbn™ Ethernet (HFC) and nbn™ Ethernet (Satellite)

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast 1:1 AVC for **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (Wireless), **nbn**™ Ethernet (HFC) and **nbn**™ Ethernet (Satellite). The bandwidth profile to be used for a unicast 1:1 AVC must be selected by Customer at the time of order.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged	F = Fibre H = HFC W = Wireless S = Satellite
1	12	1	0	0	UNI-D	4	Y	All
2	12	1	0	0.15	UNI-D	1[38]	Y	All
3	12	1	0	0.3	UNI-D	1[39]	Y	F/H/W
4	25	5	0	0	UNI-D	4	Y	All
5	25	5	0	0.15	UNI-D	-	Y	All
6	25	5	0	0.3	UNI-D	-	Y	F/H/W
7	25	5	0	0.5	UNI-D	1	Y	F/H
8	25	10	0	0	UNI-D	4	Y	F/H
9	25	10	0	0.15	UNI-D	-	Y	F/H
10	25	10	0	0.3	UNI-D	-	Y	F/H
11	25	10	0	0.5	UNI-D	-	Y	F/H

[37] Certain AVC bandwidth profiles have dependencies on the UNI-D operating mode.

[38] For this bandwidth profile, the Default-Mapped addressing mode is only available on the UNI-D in respect of **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (HFC) and **nbn**™ Ethernet (Satellite).

[39] For this bandwidth profile, the Default-Mapped addressing mode is only available on the UNI-D in respect of **nbn**™ Ethernet (Fibre) and **nbn**™ Ethernet (HFC).

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
12	25	10	0	1	UNI-D	1	Y	F/H
13	25	10	5	0	UNI-D	2	Y	F
14	25	10	5	0.15	UNI-D	-	Y	F
15	25	10	5	0.3	UNI-D	-	Y	F
16	25	10	5	0.5	UNI-D	-	Y	F
17	25-50	5-20	0	0	UNI-D	4	Y	W
18	25-50	5-20	0	0.15	UNI-D	-	Y	W
19	25-50	5-20	0	0.3	UNI-D	-	Y	W
20	50	20	0	0	UNI-D	4	Y	F/H
21	50	20	0	0.15	UNI-D	-	Y	F/H
22	50	20	0	0.3	UNI-D	-	Y	F/H
23	50	20	0	0.5	UNI-D	-	Y	F/H
24	50	20	0	1	UNI-D	-	Y	F/H
25	50	20	0	2	UNI-D	1	Y	F/H
26	50	20	5	0	UNI-D	-	Y	F
27	50	20	5	0.15	UNI-D	-	Y	F
28	50	20	5	0.3	UNI-D	-	Y	F
29	50	20	5	0.5	UNI-D	-	Y	F
30	50	20	5	1	UNI-D	-	Y	F
31	50	20	5	2	UNI-D	-	Y	F
32	50	20	10	0	UNI-D	2	Y	F
33	50	20	10	0.15	UNI-D	-	Y	F
34	50	20	10	0.3	UNI-D	-	Y	F
35	50	20	10	0.5	UNI-D	-	Y	F
36	50	20	10	1	UNI-D	-	Y	F
37	50	20	10	2	UNI-D	-	Y	F
38	100	40	0	0	UNI-D	4	Y	F/H
39	100	40	0	0.15	UNI-D	-	Y	F/H
40	100	40	0	0.3	UNI-D	-	Y	F/H
41	100	40	0	0.5	UNI-D	-	Y	F/H
42	100	40	0	1	UNI-D	-	Y	F/H
43	100	40	0	2	UNI-D	-	Y	F/H
44	100	40	0	5	UNI-D	1	Y	F/H
45	100	40	5	0	UNI-D	-	Y	F
46	100	40	5	0.15	UNI-D	-	Y	F
47	100	40	5	0.3	UNI-D	-	Y	F
48	100	40	5	0.5	UNI-D	-	Y	F
49	100	40	5	1	UNI-D	-	Y	F
50	100	40	5	2	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
51	100	40	5	5	UNI-D	-	Y	F
52	100	40	10	0	UNI-D	-	Y	F
53	100	40	10	0.15	UNI-D	-	Y	F
54	100	40	10	0.3	UNI-D	-	Y	F
55	100	40	10	0.5	UNI-D	-	Y	F
56	100	40	10	1	UNI-D	-	Y	F
57	100	40	10	2	UNI-D	-	Y	F
58	100	40	10	5	UNI-D	-	Y	F
59	100	40	20	0	UNI-D	2	Y	F
60	100	40	20	0.15	UNI-D	-	Y	F
61	100	40	20	0.3	UNI-D	-	Y	F
62	100	40	20	0.5	UNI-D	-	Y	F
63	100	40	20	1	UNI-D	-	Y	F
64	100	40	20	2	UNI-D	-	Y	F
65	250	100	0	0	UNI-D	4	Y	F
66	250	100	0	0.15	UNI-D	-	Y	F
67	250	100	0	0.3	UNI-D	-	Y	F
68	250	100	0	0.5	UNI-D	-	Y	F
69	250	100	0	1	UNI-D	-	Y	F
70	250	100	0	2	UNI-D	-	Y	F
71	250	100	0	5	UNI-D	-	Y	F
72	250	100	5	0	UNI-D	-	Y	F
73	250	100	5	0.15	UNI-D	-	Y	F
74	250	100	5	0.3	UNI-D	-	Y	F
75	250	100	5	0.5	UNI-D	-	Y	F
76	250	100	5	1	UNI-D	-	Y	F
77	250	100	5	2	UNI-D	-	Y	F
78	250	100	5	5	UNI-D	-	Y	F
79	250	100	10	0	UNI-D	-	Y	F
80	250	100	10	0.15	UNI-D	-	Y	F
81	250	100	10	0.3	UNI-D	-	Y	F
82	250	100	10	0.5	UNI-D	-	Y	F
83	250	100	10	1	UNI-D	-	Y	F
84	250	100	10	2	UNI-D	-	Y	F
85	250	100	10	5	UNI-D	-	Y	F
86	250	100	20	0	UNI-D	-	Y	F
87	250	100	20	0.15	UNI-D	-	Y	F
88	250	100	20	0.3	UNI-D	-	Y	F
89	250	100	20	0.5	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
90	250	100	20	1	UNI-D	-	Y	F
91	250	100	20	2	UNI-D	-	Y	F
92	250	100	20	5	UNI-D	-	Y	F
93	250	100	30	0	UNI-D	2	Y	F
94	250	100	30	0.15	UNI-D	-	Y	F
95	250	100	30	0.3	UNI-D	-	Y	F
96	250	100	30	0.5	UNI-D	-	Y	F
97	250	100	30	1	UNI-D	-	Y	F
98	250	100	30	2	UNI-D	-	Y	F
99	250	100	30	5	UNI-D	-	Y	F
100	250	100	40	0	UNI-D	2	Y	F
101	250	100	40	0.15	UNI-D	-	Y	F
102	250	100	40	0.3	UNI-D	-	Y	F
103	250	100	40	0.5	UNI-D	-	Y	F
104	250	100	40	1	UNI-D	-	Y	F
105	250	100	40	2	UNI-D	-	Y	F
106	250	100	40	5	UNI-D	-	Y	F
107	250	100	50	0	UNI-D	2	Y	F
108	250	100	50	0.15	UNI-D	-	Y	F
109	250	100	50	0.3	UNI-D	-	Y	F
110	250	100	50	0.5	UNI-D	-	Y	F
111	250	100	50	1	UNI-D	-	Y	F
112	250	100	50	2	UNI-D	-	Y	F
113	250	100	50	5	UNI-D	-	Y	F
114	500	200	0	0	UNI-D	4	Y	F
115	500	200	0	0.15	UNI-D	-	Y	F
116	500	200	0	0.3	UNI-D	-	Y	F
117	500	200	0	0.5	UNI-D	-	Y	F
118	500	200	0	1	UNI-D	-	Y	F
119	500	200	0	2	UNI-D	-	Y	F
120	500	200	0	5	UNI-D	-	Y	F
121	500	200	5	0	UNI-D	-	Y	F
122	500	200	5	0.15	UNI-D	-	Y	F
123	500	200	5	0.3	UNI-D	-	Y	F
124	500	200	5	0.5	UNI-D	-	Y	F
125	500	200	5	1	UNI-D	-	Y	F
126	500	200	5	2	UNI-D	-	Y	F
127	500	200	5	5	UNI-D	-	Y	F
128	500	200	10	0	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
129	500	200	10	0.15	UNI-D	-	Y	F
130	500	200	10	0.3	UNI-D	-	Y	F
131	500	200	10	0.5	UNI-D	-	Y	F
132	500	200	10	1	UNI-D	-	Y	F
133	500	200	10	2	UNI-D	-	Y	F
134	500	200	10	5	UNI-D	-	Y	F
135	500	200	20	0	UNI-D	-	Y	F
136	500	200	20	0.15	UNI-D	-	Y	F
137	500	200	20	0.3	UNI-D	-	Y	F
138	500	200	20	0.5	UNI-D	-	Y	F
139	500	200	20	1	UNI-D	-	Y	F
140	500	200	20	2	UNI-D	-	Y	F
141	500	200	20	5	UNI-D	-	Y	F
142	500	200	30	0	UNI-D	-	Y	F
143	500	200	30	0.15	UNI-D	-	Y	F
144	500	200	30	0.3	UNI-D	-	Y	F
145	500	200	30	0.5	UNI-D	-	Y	F
146	500	200	30	1	UNI-D	-	Y	F
147	500	200	30	2	UNI-D	-	Y	F
148	500	200	30	5	UNI-D	-	Y	F
149	500	200	40	0	UNI-D	-	Y	F
150	500	200	40	0.15	UNI-D	-	Y	F
151	500	200	40	0.3	UNI-D	-	Y	F
152	500	200	40	0.5	UNI-D	-	Y	F
153	500	200	40	1	UNI-D	-	Y	F
154	500	200	40	2	UNI-D	-	Y	F
155	500	200	40	5	UNI-D	-	Y	F
156	500	200	50	0	UNI-D	2	Y	F
157	500	200	50	0.15	UNI-D	-	Y	F
158	500	200	50	0.3	UNI-D	-	Y	F
159	500	200	50	0.5	UNI-D	-	Y	F
160	500	200	50	1	UNI-D	-	Y	F
161	500	200	50	2	UNI-D	-	Y	F
162	500	200	50	5	UNI-D	-	Y	F
163	500	200	60	0	UNI-D	2	Y	F
164	500	200	60	0.15	UNI-D	-	Y	F
165	500	200	60	0.3	UNI-D	-	Y	F
166	500	200	60	0.5	UNI-D	-	Y	F
167	500	200	60	1	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
168	500	200	60	2	UNI-D	-	Y	F
169	500	200	60	5	UNI-D	-	Y	F
170	500	200	70	0	UNI-D	2	Y	F
171	500	200	70	0.15	UNI-D	-	Y	F
172	500	200	70	0.3	UNI-D	-	Y	F
173	500	200	70	0.5	UNI-D	-	Y	F
174	500	200	70	1	UNI-D	-	Y	F
175	500	200	70	2	UNI-D	-	Y	F
176	500	200	70	5	UNI-D	-	Y	F
177	500	200	80	0	UNI-D	2	Y	F
178	500	200	80	0.15	UNI-D	-	Y	F
179	500	200	80	0.3	UNI-D	-	Y	F
180	500	200	80	0.5	UNI-D	-	Y	F
181	500	200	80	1	UNI-D	-	Y	F
182	500	200	80	2	UNI-D	-	Y	F
183	500	200	80	5	UNI-D	-	Y	F
184	500	200	90	0	UNI-D	2	Y	F
185	500	200	90	0.15	UNI-D	-	Y	F
186	500	200	90	0.3	UNI-D	-	Y	F
187	500	200	90	0.5	UNI-D	-	Y	F
188	500	200	90	1	UNI-D	-	Y	F
189	500	200	90	2	UNI-D	-	Y	F
190	500	200	90	5	UNI-D	-	Y	F
191	500	200	100	0	UNI-D	2	Y	F
192	500	200	100	0.15	UNI-D	-	Y	F
193	500	200	100	0.3	UNI-D	-	Y	F
194	500	200	100	0.5	UNI-D	-	Y	F
195	500	200	100	1	UNI-D	-	Y	F
196	500	200	100	2	UNI-D	-	Y	F
197	500	200	100	5	UNI-D	-	Y	F
198	1000	400	0	0	UNI-D	4	Y	F
199	1000	400	0	0.15	UNI-D	-	Y	F
200	1000	400	0	0.3	UNI-D	-	Y	F
201	1000	400	0	0.5	UNI-D	-	Y	F
202	1000	400	0	1	UNI-D	-	Y	F
203	1000	400	0	2	UNI-D	-	Y	F
204	1000	400	0	5	UNI-D	-	Y	F
205	1000	400	5	0	UNI-D	-	Y	F
206	1000	400	5	0.15	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
207	1000	400	5	0.3	UNI-D	-	Y	F
208	1000	400	5	0.5	UNI-D	-	Y	F
209	1000	400	5	1	UNI-D	-	Y	F
210	1000	400	5	2	UNI-D	-	Y	F
211	1000	400	5	5	UNI-D	-	Y	F
212	1000	400	10	0	UNI-D	-	Y	F
213	1000	400	10	0.15	UNI-D	-	Y	F
214	1000	400	10	0.3	UNI-D	-	Y	F
215	1000	400	10	0.5	UNI-D	-	Y	F
216	1000	400	10	1	UNI-D	-	Y	F
217	1000	400	10	2	UNI-D	-	Y	F
218	1000	400	10	5	UNI-D	-	Y	F
219	1000	400	20	0	UNI-D	-	Y	F
220	1000	400	20	0.15	UNI-D	-	Y	F
221	1000	400	20	0.3	UNI-D	-	Y	F
222	1000	400	20	0.5	UNI-D	-	Y	F
223	1000	400	20	1	UNI-D	-	Y	F
224	1000	400	20	2	UNI-D	-	Y	F
225	1000	400	20	5	UNI-D	-	Y	F
226	1000	400	30	0	UNI-D	-	Y	F
227	1000	400	30	0.15	UNI-D	-	Y	F
228	1000	400	30	0.3	UNI-D	-	Y	F
229	1000	400	30	0.5	UNI-D	-	Y	F
230	1000	400	30	1	UNI-D	-	Y	F
231	1000	400	30	2	UNI-D	-	Y	F
232	1000	400	30	5	UNI-D	-	Y	F
233	1000	400	40	0	UNI-D	-	Y	F
234	1000	400	40	0.15	UNI-D	-	Y	F
235	1000	400	40	0.3	UNI-D	-	Y	F
236	1000	400	40	0.5	UNI-D	-	Y	F
237	1000	400	40	1	UNI-D	-	Y	F
238	1000	400	40	2	UNI-D	-	Y	F
239	1000	400	40	5	UNI-D	-	Y	F
240	1000	400	50	0	UNI-D	2	Y	F
241	1000	400	50	0.15	UNI-D	-	Y	F
242	1000	400	50	0.3	UNI-D	-	Y	F
243	1000	400	50	0.5	UNI-D	-	Y	F
244	1000	400	50	1	UNI-D	-	Y	F
245	1000	400	50	2	UNI-D	-	Y	F

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[37]		Availability by Access Technology
246	1000	400	50	5	UNI-D	-	Y	F
247	1000	400	60	0	UNI-D	2	Y	F
248	1000	400	60	0.15	UNI-D	-	Y	F
249	1000	400	60	0.3	UNI-D	-	Y	F
250	1000	400	60	0.5	UNI-D	-	Y	F
251	1000	400	60	1	UNI-D	-	Y	F
252	1000	400	60	2	UNI-D	-	Y	F
253	1000	400	60	5	UNI-D	-	Y	F
254	1000	400	70	0	UNI-D	2	Y	F
255	1000	400	70	0.15	UNI-D	-	Y	F
256	1000	400	70	0.3	UNI-D	-	Y	F
257	1000	400	70	0.5	UNI-D	-	Y	F
258	1000	400	70	1	UNI-D	-	Y	F
259	1000	400	70	2	UNI-D	-	Y	F
260	1000	400	70	5	UNI-D	-	Y	F
261	1000	400	80	0	UNI-D	2	Y	F
262	1000	400	80	0.15	UNI-D	-	Y	F
263	1000	400	80	0.3	UNI-D	-	Y	F
264	1000	400	80	0.5	UNI-D	-	Y	F
265	1000	400	80	1	UNI-D	-	Y	F
266	1000	400	80	2	UNI-D	-	Y	F
267	1000	400	80	5	UNI-D	-	Y	F
268	1000	400	90	0	UNI-D	2	Y	F
269	1000	400	90	0.15	UNI-D	-	Y	F
270	1000	400	90	0.3	UNI-D	-	Y	F
271	1000	400	90	0.5	UNI-D	-	Y	F
272	1000	400	90	1	UNI-D	-	Y	F
273	1000	400	90	2	UNI-D	-	Y	F
274	1000	400	90	5	UNI-D	-	Y	F
275	1000	400	100	0	UNI-D	-	Y	F
276	1000	400	100	0.15	UNI-D	-	Y	F
277	1000	400	100	0.3	UNI-D	-	Y	F
278	1000	400	100	0.5	UNI-D	-	Y	F
279	1000	400	100	1	UNI-D	-	Y	F
280	1000	400	100	2	UNI-D	-	Y	F
281	1000	400	100	5	UNI-D	-	Y	F

Table 31: Unicast 1:1 AVC Bandwidth Profiles - nbn™ Ethernet (Fibre), nbn™ Ethernet (Wireless), nbn™ Ethernet (HFC) and nbn™ Ethernet (Satellite)

Notes:

- **nbn** may limit the availability of bandwidth profiles with TC-1 capacities greater than 1 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-1 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-1 capacities greater than 1 Mbps in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-2 capacities greater than 10 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-2 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-2 in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-4 capacities greater than 100 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-4 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-4 capacities greater than 100 Mbps in relation to each Premises.
- Only a subset of bandwidth profiles is available in relation to each of **nbn**™ Ethernet (Fibre), **nbn**™ Ethernet (Wireless), **nbn**™ Ethernet (HFC) and **nbn**™ Ethernet (Satellite). Additional restrictions may apply to the supply of certain of those bandwidth profiles.

B.2 Unicast 1:1 AVC Bandwidth Profiles for nbn™ Ethernet (FTTB) and nbn™ Ethernet (FTTN)

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast 1:1 AVC for **nbn**™ Ethernet (FTTB) and **nbn**™ Ethernet (FTTN). The bandwidth profile to be used for a unicast 1:1 AVC must be selected by Customer at the time of order.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-DSL Supported Interface Mode[40]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
1	12	1	0	0	UNI-DSL	4	Y
2	12	1	0	0.15	UNI-DSL	1	Y
3	12	1	0	0.3	UNI-DSL	1	Y
4	25	5	0	0	UNI-DSL	4	Y
5	25	5	0	0.15	UNI-DSL	-	Y
6	25	5	0	0.3	UNI-DSL	-	Y
7	25	5	0	0.5	UNI-DSL	1	Y
8	25	5-10	0	0	UNI-DSL	4	Y
9	25	5-10	0	0.15	UNI-DSL	-	Y
10	25	5-10	0	0.3	UNI-DSL	-	Y
11	25	5-10	0	0.5	UNI-DSL	-	Y
12	25	5-10	0	1	UNI-DSL	1	Y
13	25	5-10	5	0	UNI-DSL	2	Y
14	25	5-10	5	0.15	UNI-DSL	-	Y
15	25	5-10	5	0.3	UNI-DSL	-	Y
16	25	5-10	5	0.5	UNI-DSL	-	Y
17	25-50	5-20	0	0	UNI-DSL	4	Y
18	25-50	5-20	0	0.15	UNI-DSL	-	Y
19	25-50	5-20	0	0.3	UNI-DSL	-	Y
20	25-50	5-20	0	0.5	UNI-DSL	-	Y
21	25-50	5-20	0	1	UNI-DSL	-	Y
22	25-50	5-20	0	2	UNI-DSL	1	Y
23	25-50	5-20	5	0	UNI-DSL	-	Y
24	25-50	5-20	5	0.15	UNI-DSL	-	Y

[40] Certain AVC bandwidth profiles have dependencies on the UNI-DSL operating mode.

Profile Number	AVC_TC-4 (downstream)	AVC_TC-4 (upstream)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-DSL Supported Interface Mode[40]	
25	25-50	5-20	5	0.3	UNI-DSL	-	Y
26	25-50	5-20	5	0.5	UNI-DSL	-	Y
27	25-50	5-20	5	1	UNI-DSL	-	Y
28	25-50	5-20	5	2	UNI-DSL	-	Y
29	25-50	5-20	10	0	UNI-DSL	2	Y
30	25-50	5-20	10	0.15	UNI-DSL	-	Y
31	25-50	5-20	10	0.3	UNI-DSL	-	Y
32	25-50	5-20	10	0.5	UNI-DSL	-	Y
33	25-50	5-20	10	1	UNI-DSL	-	Y
34	25-50	5-20	10	2	UNI-DSL	-	Y
35	25-100	5-40	0	0	UNI-DSL	4	Y
36	25-100	5-40	0	0.15	UNI-DSL	-	Y
37	25-100	5-40	0	0.3	UNI-DSL	-	Y
38	25-100	5-40	0	0.5	UNI-DSL	-	Y
39	25-100	5-40	0	1	UNI-DSL	-	Y
40	25-100	5-40	0	2	UNI-DSL	-	Y
41	25-100	5-40	0	5	UNI-DSL	1	Y
42	25-100	5-40	5	0	UNI-DSL	-	Y
43	25-100	5-40	5	0.15	UNI-DSL	-	Y
44	25-100	5-40	5	0.3	UNI-DSL	-	Y
45	25-100	5-40	5	0.5	UNI-DSL	-	Y
46	25-100	5-40	5	1	UNI-DSL	-	Y
47	25-100	5-40	5	2	UNI-DSL	-	Y
48	25-100	5-40	5	5	UNI-DSL	-	Y
49	25-100	5-40	10	0	UNI-DSL	-	Y
50	25-100	5-40	10	0.15	UNI-DSL	-	Y
51	25-100	5-40	10	0.3	UNI-DSL	-	Y
52	25-100	5-40	10	0.5	UNI-DSL	-	Y
53	25-100	5-40	10	1	UNI-DSL	-	Y
54	25-100	5-40	10	2	UNI-DSL	-	Y
55	25-100	5-40	10	5	UNI-DSL	-	Y
56	25-100	5-40	20	0	UNI-DSL	2	Y
57	25-100	5-40	20	0.15	UNI-DSL	-	Y
58	25-100	5-40	20	0.3	UNI-DSL	-	Y
59	25-100	5-40	20	0.5	UNI-DSL	-	Y
60	25-100	5-40	20	1	UNI-DSL	-	Y
61	25-100	5-40	20	2	UNI-DSL	-	Y

Table 32: Unicast 1:1 AVC Bandwidth Profiles - nbn™ Ethernet (FTTB) and nbn™ Ethernet (FTTN)

Notes:

- **nbn** may limit the availability of bandwidth profiles with TC-1 capacities greater than 1 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-1 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-1 capacities greater than 1 Mbps in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-2 capacities greater than 10 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-2 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-2 in relation to each Premises.
- Additional restrictions may apply to the supply of certain of these bandwidth profiles.

B.3 Unicast 1:1 AVC Bandwidth Profiles for nbn™ Ethernet (FTTC)

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast 1:1 AVC for **nbn**™ Ethernet (FTTC). The bandwidth profile to be used for a unicast 1:1 AVC must be selected by Customer at the time of order.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-2 (upstream, downstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode[41]	
						Default-Mapped (Traffic Class)	DSCP-Mapped, Priority-Tagged and Tagged
1	12	1	0	0	UNI-D	4	Y
2	12	1	0	0.15	UNI-D	1	Y
3	12	1	0	0.3	UNI-D	1	Y
4	25	5	0	0	UNI-D	4	Y
5	25	5	0	0.15	UNI-D	-	Y
6	25	5	0	0.3	UNI-D	-	Y
7	25	5	0	0.5	UNI-D	1	Y
8	25	5-10	0	0	UNI-D	4	Y
9	25	5-10	0	0.15	UNI-D	-	Y
10	25	5-10	0	0.3	UNI-D	-	Y
11	25	5-10	0	0.5	UNI-D	-	Y
12	25	5-10	0	1	UNI-D	1	Y
13	25	5-10	5	0	UNI-D	2	Y
14	25	5-10	5	0.15	UNI-D	-	Y
15	25	5-10	5	0.3	UNI-D	-	Y
16	25	5-10	5	0.5	UNI-D	-	Y
17	25-50	5-20	0	0	UNI-D	4	Y
18	25-50	5-20	0	0.15	UNI-D	-	Y
19	25-50	5-20	0	0.3	UNI-D	-	Y
20	25-50	5-20	0	0.5	UNI-D	-	Y
21	25-50	5-20	0	1	UNI-D	-	Y
22	25-50	5-20	0	2	UNI-D	1	Y
23	25-50	5-20	5	0	UNI-D	-	Y
24	25-50	5-20	5	0.15	UNI-D	-	Y

[41] Certain AVC bandwidth profiles have dependencies on the UNI-D operating mode.

Profile Number	AVC_TC-4 (downstream)	AVC_TC-4 (upstream)	AVC_TC-2 (upstream, downstream)	AVC_TC-1 (upstream, downstream)	UNI Interface	UNI-D Supported Interface Mode[41]	
25	25-50	5-20	5	0.3	UNI-D	-	Y
26	25-50	5-20	5	0.5	UNI-D	-	Y
27	25-50	5-20	5	1	UNI-D	-	Y
28	25-50	5-20	5	2	UNI-D	-	Y
29	25-50	5-20	10	0	UNI-D	2	Y
30	25-50	5-20	10	0.15	UNI-D	-	Y
31	25-50	5-20	10	0.3	UNI-D	-	Y
32	25-50	5-20	10	0.5	UNI-D	-	Y
33	25-50	5-20	10	1	UNI-D	-	Y
34	25-50	5-20	10	2	UNI-D	-	Y
35	25-100	5-40	0	0	UNI-D	4	Y
36	25-100	5-40	0	0.15	UNI-D	-	Y
37	25-100	5-40	0	0.3	UNI-D	-	Y
38	25-100	5-40	0	0.5	UNI-D	-	Y
39	25-100	5-40	0	1	UNI-D	-	Y
40	25-100	5-40	0	2	UNI-D	-	Y
41	25-100	5-40	0	5	UNI-D	1	Y
42	25-100	5-40	5	0	UNI-D	-	Y
43	25-100	5-40	5	0.15	UNI-D	-	Y
44	25-100	5-40	5	0.3	UNI-D	-	Y
45	25-100	5-40	5	0.5	UNI-D	-	Y
46	25-100	5-40	5	1	UNI-D	-	Y
47	25-100	5-40	5	2	UNI-D	-	Y
48	25-100	5-40	5	5	UNI-D	-	Y
49	25-100	5-40	10	0	UNI-D	-	Y
50	25-100	5-40	10	0.15	UNI-D	-	Y
51	25-100	5-40	10	0.3	UNI-D	-	Y
52	25-100	5-40	10	0.5	UNI-D	-	Y
53	25-100	5-40	10	1	UNI-D	-	Y
54	25-100	5-40	10	2	UNI-D	-	Y
55	25-100	5-40	10	5	UNI-D	-	Y
56	25-100	5-40	20	0	UNI-D	2	Y
57	25-100	5-40	20	0.15	UNI-D	-	Y
58	25-100	5-40	20	0.3	UNI-D	-	Y
59	25-100	5-40	20	0.5	UNI-D	-	Y
60	25-100	5-40	20	1	UNI-D	-	Y
61	25-100	5-40	20	2	UNI-D	-	Y

Table 33: Unicast 1:1 AVC Bandwidth Profiles - nbn™ Ethernet (FTTC)

Notes:

- **nbn** may limit the availability of bandwidth profiles with TC-1 capacities greater than 1 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-1 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-1 capacities greater than 1 Mbps in relation to each Premises.
- **nbn** may limit the availability of bandwidth profiles with TC-2 capacities greater than 10 Mbps in CSAs where **nbn** does not, or considers it is likely to not, have sufficient capacity to provide all requested TC-2 capacity. Customer must conduct a Site Qualification Enquiry which will indicate the availability of bandwidth profiles for TC-2 in relation to each Premises.
- Additional restrictions may apply to the supply of certain of these bandwidth profiles.

B.4 Unicast N:1 AVC Bandwidth Profiles

This table shows the valid combinations that may be used to populate the bandwidth profile (upstream and downstream) for a unicast N:1 AVC, as required for UNI-V operation. Note that the unicast N:1 AVC bandwidth profile is automatically set by **nbn** as per the single profile listed in this table.

Profile Number	AVC_TC-4 (downstream) (Mbps)	AVC_TC-4 (upstream) (Mbps)	AVC_TC-1 (upstream, downstream) (Mbps)	UNI Interface	UNI-D Supported Interface Mode
1	0	0	0.15	UNI-V	N/A

Table 34: Unicast N:1 AVC Bandwidth Profiles

B.5 Multicast AVC Bandwidth Profiles

This table shows the valid combinations that may be used to populate the bandwidth profile (downstream only) for a Multicast AVC. The bandwidth profile to be used for a Multicast AVC must be selected by Customer at the time of order.

Profile Number	AVC_TC-MC (Mbps)	UNI Interface	UNI-D Supported Interface Mode			
			Default-Mapped	DSCP-Mapped	Priority-Tagged	Tagged
1	5	UNI-D	Y	Y	N	N
2	20	UNI-D	Y	Y	N	N
3	30	UNI-D	Y	Y	N	N
4	40	UNI-D	Y	Y	N	N
5	50	UNI-D	Y	Y	N	N

Table 35: Multicast AVC Bandwidth Profiles

B.6 CVC Bandwidth Profiles

B.6.1 Unicast 1:1 and N:1 CVC Bandwidth Profiles

The bandwidth profile for a unicast CVC may be constructed by independently selecting the TC-1, TC-2 and TC-4 capacities, from the following tables, provided that the total combination of CVC bandwidth profiles is not zero.[42]

Profile Number	CVC_TC-1 (Mbps)
1	0
2	5
3	10
4	20
5	25
6	30
7	40
8	50
9	60
10	80
11	100
12	120
13	150
14	200
15	250
16	300
17	400
18	500

Table 36: Unicast CVC TC-1 Bandwidth Profile Capacities[43]

Profile Number	CVC_TC-2 (Mbps)
1	0
2	5
3	10
4	20

[42] Provided the selected combination does not exceed the capacity within an NNI Group as described in section 6.3.

[43] Available for unicast CVC services configured as N:1 or 1:1.

Profile Number	CVC_TC-2 (Mbps)
5	25
6	30
7	40
8	50
9	60
10	80
11	100
12	120
13	150
14	200
15	250
16	300
17	400
18	500
19	600
20	700
21	800
22	900
23	1000

Table 37: Unicast CVC TC-2 Bandwidth Profile Capacities[44]

Profile Number	CVC_TC-4 (Mbps)
1	0
2	100
3	150
4	200
5	250
6	300
7	400
8	500
9	600

[44] Available for unicast CVC services configured as 1:1 only.

Profile Number	CVC_TC-4 (Mbps)
10	700
11	800
12	900
13	1000
14	1100
15	1200
16	1300
17	1400
18	1500
19	1600
20	1700
21	1800
22	1900
23	2000
24	2100
25	2200
26	2300
27	2400
28	2500
29	2600
30	2700
31	2800
32	2900
33	3000
34	3100
35	3200
36	3300
37	3400
38	3500
39	3600
40	3700
41	3800
42	3900
43	4000
44	4100
45	4200
46	4300

Profile Number	CVC_TC-4 (Mbps)
47	4400
48	4500
49	4600
50	4700
51	4800
52	4900
53	5000
54	5100
55	5200
56	5300
57	5400
58	5500
59	5600
60	5700
61	5800
62	5900
63	6000
64	6100
65	6200
66	6300
67	6400
68	6500
69	6600
70	6700
71	6800
72	6900
73	7000
74	7100
75	7200
76	7300
77	7400
78	7500
79	7600
80	7700
81	7800
82	7900
83	8000

Profile Number	CVC_TC-4 (Mbps)
84	8100
85	8200
86	8300
87	8400
88	8500
89	8600
90	8700
91	8800
92	8900
93	9000
94	9100
95	9200
96	9300
97	9400
98	9500
99	9600
100	9700
101	9800
102	9900
103	10,000

Table 38: Unicast CVC TC-4 Bandwidth Profile Capacities[45]

[45] Available for unicast CVC services configured as 1:1 only.

B.7 CVC Class Attributes for nbn™ Ethernet (Satellite)

The AVC-related bandwidth profile for each unicast CVC supplied for **nbn**™ Ethernet (Satellite) may be selected from the following table.

CVC TC-4 Bandwidth (Mbps)	Minimum number of AVCs that must be associated with each Satellite CVC TC-4		
	CVC Class-0 (Default)	CVC Class-1 (Premium)	CVC Class-2 (Premium)
0	0	0	0
100	0	0	0
125	235	190	170
150	317	264	236
175	399	338	302
200	481	412	368
225	563	486	434
250	645	560	500
275	727	634	566
300	809	708	632
325	891	782	698
350	973	856	764
365	1055	930	830
400	1137	1004	896
425	1219	1078	962
450	1301	1152	1028
475	1383	1226	1094
500	1465	1300	1160
525	1547	1374	1226
550	1629	1448	1292
575	1711	1522	1358
600	1793	1596	1424
625	1875	1670	1490
650	1957	1744	1556
675	2039	1818	1622
700	2121	1892	1688
725	2203	1966	1754

CVC TC-4 Bandwidth (Mbps)	Minimum number of AVCs that must be associated with each Satellite CVC TC-4		
	CVC Class-0 (Default)	CVC Class-1 (Premium)	CVC Class-2 (Premium)
750	2285	2040	1820
775	2367	2114	1886
800	2449	2188	1952
825	2531	2262	2018
850	2613	2336	2084
875	2695	2410	2150
900	2777	2484	2216
925	2859	2558	2282
950	2941	2632	2348
975	3023	2706	2414
1000	3105	2780	2480

Table 39: Satellite unicast CVC TC-4 Bandwidth Profile Capacities and Minimum AVC Thresholds[46]

[46] Available for unicast CVC services configured as 1:1 only and subject to the minimum AVC thresholds per CVC Class for **nbn**™ Ethernet (Satellite): see sections 2.2(d) and 2.2(e) of the **nbn**™ Ethernet Product Description.

B.8 Multicast Domain Bandwidth Profiles

The bandwidth profile for a Multicast Domain may be constructed by selecting the TC-MC capacity from the following table.

Profile Number	CVC TC-MC (Mbps)
1	100
2	200
3	300
4	400
5	500
6	600
7	700
8	800
9	900
10	1000

Table 40: Multicast Domain TC-MC Bandwidth Profile Capacities